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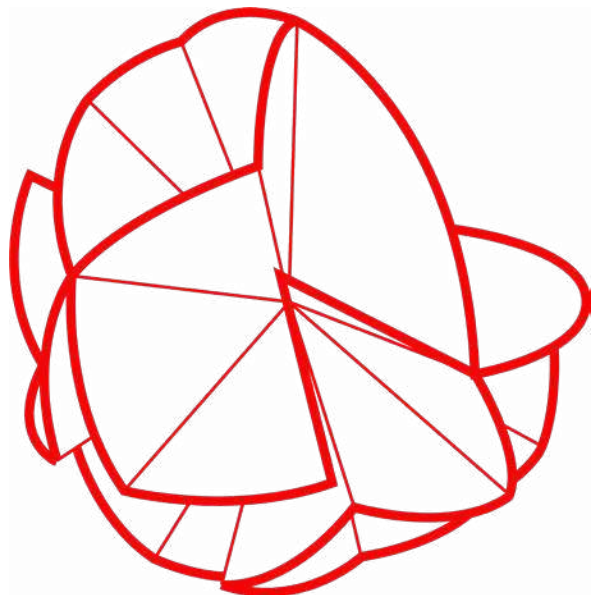
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1

Disrupting Geographies in the Design World

Proceedings of the 8th International
Forum of Design as a Process

Alma Mater Studiorum — Università di Bologna

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(Eds.)
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The Latin Network for the Development of Design Processes

The Latin Network for the Development of Design Processes is a group of researchers, academics, students and business professionals of Latin languages and cultures who study and operate in a particular field of design known as design processes. They meet in a Forum, conceived as an international specialised conference, to engage in lively discussions and debates about their studies and experiences.

The Network was founded in 2008 with the “Carta di Torino” manifesto. Since its very beginning, Professor Ph.D. Flaviano Celaschi has been leading a team that, over the years, guaranteed the cultural and scientific focus of the members of the Network, fostering inter-institutional cooperation. Since 2015, the Network has been hosted by the Alma Mater Studiorum – Università di Bologna, within the Advanced Design Unit (ADU) of the Department of Architecture, coordinated by Professor Ph.D. Elena Formia.



So far, the members organised eight Forums, covering the following thematic axes:

Design Cultures as Models of Biodiversity

1st Edition

Universidade do Vale do Rio dos Sinos, Porto Alegre, Brazil

June 24-26, 2009

Design, Art, Craft: Cross-fertilizations and Experiences

2nd Edition

Universidade de Aveiro, Aveiro, Portugal

October 28-30, 2010

Innovation in Design Education

3rd Edition

Politecnico di Torino, Torino, Italy

November 3-5, 2011

Diversity: Design/Humanities

4th Edition

Universidade do Estado de Minas Gerais

– UEMG, Belo Horizonte, Brazil

September 19-22, 2012

Advanced Design Cultures. The Shapes of the Future as the Front End of Design-Driven Innovation

5th Edition

Tecnológico de Monterrey, Campus Guadalajara, Mexico

September 18-20, 2014

Systems & Design. Beyond Processes and Thinking

6th Edition

Universitat Politècnica de València, València, Spain

June 22-24, 2016

Design & Territory: Emergencies and Conflicts

7th Edition

Universidad Nacional de Colombia, Sede Palmira, Colombia

June 23, 2020

Disrupting Geographies in the Design World

8th Edition

Alma Mater Studiorum — Università di Bologna, Bologna, Italy

June 20-22, 2022

For more information about the Editions and related publications, see: <https://www.forumdesignprocess.org/dgdw22/past-editions/>

8th Forum Main Partners

Alma Mater Studiorum — Università di Bologna Advanced Design Unit Department of Architecture

The Advanced Design Unit is a community of professors, researchers and experts who deal with design cultures and their continuous innovation. It operates in the University of Bologna through teaching activities, research, and the third mission.

<https://site.unibo.it/advanceddesignunit/it>

Tecnológico de Monterrey (TEC)

Established in 1943, Tecnológico de Monterrey is a distinguished private nonprofit university dedicated to cultivating leaders with robust entrepreneurial acumen and a profound sense of humanity, making them globally competitive. With a presence in 26 cities across Mexico, the university boasts a student enrollment exceeding 65,000, encompassing both undergraduate and doctoral programs. Garnering recognition on the global stage, the QS World University Rankings (2021) position Tecnológico de Monterrey at an impressive 155th worldwide. Within its esteemed Escuela de Arquitectura, Arte y Diseño, the university nurtures talents in Architecture, Digital Art, Design, and Urbanism.

<https://tec.mx/es>

Pontificia Universidad Católica de Chile School of Design

The UC School of Design equips professionals to navigate intricate scenarios, addressing challenges stemming from the ever-evolving landscape of scientific and technological advancements and the socioeconomic and cultural intricacies of the contemporary world. Rooted in the ethical principles of the University, this educational endeavour places particular emphasis on fostering creative intelligence, nurturing critical thinking, and cultivating social sensitivity.

www.disenho.uc.cl

diid disegno industriale industrial design

diid is an open-access, peer-reviewed scientific design journal published three times a year. It was founded in 2002 to fill a gap concerning scientific journals in Italy related to industrial design and design studies. Over the last two decades, *diid* has investigated design disciplines and practices, recording their development thanks to the significant contribution of Italian and international scientific communities. The one inaugurated in 2021, with issue no. 73, is a new phase. The journal, while exploring advanced design cultures, delves into specific aspects such as anticipation, narratives of complex systems belonging to the evolving landscape of capitalism and relational dynamics, the front-end of innovation, the avant-garde of theoretical and applied design debates. The pivotal theme under the lens of analysis is transformation, aiming to comprehend its various impacts and meanings within the realms of innovation domains. With this approach, it aims at overpassing spatial, cultural, economic, and technological boundaries giving voice to design research coming from different areas.

<https://www.diid.it/diid/index.php/diid>

8th International Forum of Design as a Process

Disrupting Geographies in the Design World

**Alma Mater Studiorum — Università di Bologna
Bologna, June 20-22, 2022**



**Responsible Innovation
Social Justice
Ecocentrism
Changing Education**

www.forumdesignprocess.org/dgdw22

How design is evolving to respond to the urgent needs facing our environment and society at large? How to understand and design the dynamic relations between artefacts, human beings and the ecosphere? How might design principles and practices adapt their approaches to attend to the diversity that characterised the world?

In an increasingly globalized world, new geographies in and of design offer the stage for negotiating ecosystem's complexity. Design is positioned as a key driver for improving the living standards of many, where human and environmental capitals are pivotal in local economies, and also for the connection to the rest of the world.

The 8th International Forum of Design as a Process (Bologna, June 20-22, 2022) featured speakers from the Global Design community, expanding the original vocation of the Latin Network for the Development of Design as a Process to include researchers and designers of the Mediterranean Area, Middle East, IOR (Indian Ocean Region), and Global South regions. The aim was sharing new perspectives on design futures with responsibility and justice, at the forefront of change, establishing strategic partnerships, and creating accessible knowledge.

The Forum, spanning three-days of meetings, reflection opportunities and networking activities, involved designers, scholars, young researchers, design entrepreneurs, opinion leaders, in an experimental format. Grounded in three pillars – seminars, workshops, and exhibitions –, the event aimed to attract audiences to Bologna, consolidating the potentials of the design world as hub for thought and creative production for present and future generations.

Speakers' contributions inspired the designers' community of practices, and resonated with students and the wide community, to connect design to all aspects of culture and life. This interdisciplinary approach explored the intersections of materiality and culture, post-coloniality, decoloniality, gender studies, and other areas of human thought and action which seek to analyze, question and challenge the disruptive geographies in the world, today.

Five tracks were proposed to address the different dimensions of design futures centered on responsibility and justice.

The submitted papers were reviewed, and a selection is published in this Digital Special Issue of *diid. disegno industriale – industrial design*. Each track begins with a red page containing the original text used in 2022 for the call for papers, also indicating the names of Chairs, Co-Chairs, and Track Editors. Following this, an introductory paper outlines the contents published in the form of research articles for each track.

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Disrupting Geographies in the Design World

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Realists of a Larger Reality: Cities, Political Imagination and Social Creativity

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in the Workshop
“Strange Wonder”**

Track 1

There's No Plan(et) B: Sustainable Transitions to Systemic Planet- Centric Design

Along with the effects of climate change and the social unrest that has spread around the world in the past years, the recent health emergency for COVID-19 pandemic has exacerbated inequalities and injustices at different scales, and has severely tested the resilience of individuals, communities, institutions, and businesses. Current crises, in their multiple manifestations, have exposed the profound instability affecting the planet and brought to the surface many complex situations that require urgent intervention.

In this scenario, design is once again called to reconsider, as a discipline and as a practice, its traditional role towards society and the environment, and to redefine its methods, tools, and processes to offer better solutions for products and services that not only do not harm our surroundings, but also contribute to healing the conflicts that affect both humans and all other beings that inhabit the planet and interrelate as a single living system. The challenge is therefore to encourage and facilitate transitions towards more sustainable and circular patterns of production and consumption, adopting a systemic and planet-centric approach, reinforcing the ethical responsibilities of design, and reaffirming its mediating role in the resolution of the wicked problems that characterise the contemporaneity.

This track invited researchers, educators, practitioners, and students, to share their reflections and experiences concerning design-led processes that bring to the disruption with traditional practices and the transition to alternative forms of thinking and acting, aiming to address current crises and lay the foundations for more sustainable future.

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There's No Plan(et) B. Sustainable Transitions to Systemic Planet-Centric Design

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Abstract

The current environmental, social, and economic crises have laid bare the profound instability plaguing the planet and brought to light many complex situations that require urgent action. Design is called once again to reconsider, as a discipline and as a practice, its role towards society and the environment, and to redefine methods, tools, and processes to offer solutions that not only do not harm the surrounding environment, but also help heal the conflicts that affect human beings and all other beings inhabiting the planet as one living system. The goal is to promote transitions to more sustainable and circular production and consumption patterns by taking a systemic, planet-centered approach, strengthening the ethical responsibilities of design, and reaffirming its mediating role in solving the wicked problems that characterize the contemporary world. Within this framework, reflections, and experiences from the field of design research were gathered to highlight disruptions with traditional practices and possible paths of transition to alternative forms of thought and action, with the aim of addressing current crises and laying the groundwork for a more sustainable future.

Keywords

**Sustainability
Ethics
Transitions
Systemic Approach
Planet-Centricity**

A Mutable and Unstable Scenario: The Emergence of Polycrisis

Whether it is the effects of climate change, pollution or loss of biodiversity, the planet is facing some of the greatest challenges it has ever known. This triple planetary crisis of an environmental nature (UN Climate Change, 2022), together with the multiple social, political, and economic issues that are affecting the entire world (Bauman & Bordoni, 2014), are questioning current paradigms, existing production, and consumption models and, in general, people's current lifestyles (Lefebvre, 2014). On the other hand, equity and social inclusion, political freedom, and economic equality, are some of the main demands, often unfortunately unheeded, which activists and protesters address to governments asking them to take concrete actions and activate processes of change to tackle a scenario that is increasingly VUCA (Bennis, Bennis & Nanus, 1986), an acronym for Volatility, Uncertainty, Complexity and Ambiguity.

Looking at the different crises, it can be observed that they are synchronized with deeply interconnected impacts. According to WWF (World Wildlife Fund, n.d.), for example, Covid-19 is “the indirect consequence of our impact on natural ecosystems”, and deforestation is paving the way for species jumping, the so-called “spillover” phenomenon (Pratesi, Galaveri & Antonelli, 2020). Indeed, virologist Ilaria Capua (2020), by coining the concept of “Circular Health”, proposes an integrated approach that aims to sustainably balance the health of people, animals, and ecosystems (One Health Center of Excellence-UF/IFAS, n.d.).

From the devastating effects of deforestation to the exponential increase in waste and ocean pollution, from the social protests that have erupted in recent years to the health emergency caused by the Covid-19 pandemic, to the more recent invasion of Ukraine by Russia, which has put international diplomatic relations in check, global crises are constantly intensifying, causing global instability, increasing inequalities between rich and poor, and exacerbating the so-called “North-South divide” (Glenn, 2007). We are living in a state of “permacrisis” (Turnbull, 2022), that is, “an extended period of instability and insecurity, especially one resulting from a series of catastrophic events” (Collins English Dictionary, n.d.), also known as “polycrisis” (Lawrence, Janzwood & Homer-Dixon, 2022), defined as “an array of grave, long-term challenges, now often labelled *global systemic risks*” (Cascade Institute, 2022).

The term “crisis” comes from the Greek word *krisis*, meaning “decision”, and the verb *krino*, which refers to the action of discerning, judging, and deciding; it designates the moment when there is a rupture or a very marked change in a given situation, such as an illness or a significant modification in nature, in the life of a person or a community (Fernández López, n.d.). The term has an agrarian origin, linked to the harvesting of wheat: for an ancient Greek, “crisis” is the process that occurs when the grain is separated from the chaff, an analytical division that allows only the good or usable part of the harvest to be kept, an operation that requires judgment (Alcoberro, n.d.). Therefore, being in crisis implies facing a conflictual or unbalanced situation, which involves a choice; it is an opportunity to generate significant transformation, since it

implies making a decision, opting for one path, and renouncing another. Such choice, however, must be made wisely and considering the consequences of each alternative: it is, thus, necessary to choose “critically” (from the word *kritikós*, related to the “ability to discern”) and judiciously, that is, with “criterion” (another word derived from the Greek and meaning “court of justice”).

A crisis, as such, is not necessarily negative and, if approached appropriately, can become an important opportunity for positive change, even when addressed by Design (Scherling & DeRosa, 2020). Modern philosopher Reinhart Koselleck (Koselleck & Richter, 2006) sees a semantic shift in the notion of crisis today, speaking of a contradiction between opposing forces that accelerates the transition from the past to the future (Turnbull, 2022).

In that sense, it is necessary to bring back to the center of reflection the notion of “ethical responsibility” or “ethics of responsibility”, an expression introduced by the political scientist Max Weber (1919) and later adopted by Hans Jonas (1979) as the basis for defining so-called “Sustainable Development” (The World Commission on Environment and Development, 1987). “Ethics” derives etymologically from the Greek *ethos*, meaning “behavior”, while the word “responsibility” derives from the Latin *respondeo*, which has the same origin as “to respond”. The “ethics of responsibility” could hence be defined as “behavior capable of responding to someone or something”. In other words, acting with ethical responsibility implies considering the effects and consequences of one’s actions, and it is by anticipating these effects and consequences, and making oneself accountable for them, that decisions are made.

The Evolution of Design Coping with Contemporary Crises

Although many authors locate Design at the center of the contemporary crises (Fry & Nocek 2021) a more critical approach to “problem solving”, which has distinguished the discipline so far, can in fact contribute to creatively reformulating possible solutions and imagining new ways of dealing with complex issues and so-called “wicked problems” (Rittel & Webber, 1973; Sweeting, 2018), which are characterized, among their main features, by a strong social impact, the involvement of multiple actors in the decision-making process and the presence of confusing information, which makes their resolution even more complicated. Wicked problems are often classified as difficult or even impossible to solve: consequently, tackling them requires divergent thinking and creativity, with a direct impact on design methods and practices.

In recent decades, in response to increasing uncertainty and complexity, the discipline of Design has adapted to new challenges through profound structural changes that have redefined its approaches and objectives, by becoming more advanced in its methods (de Bont et al., 2013) and more strategic in its perspectives (Zurlo et al., 2002; Zurlo, 2004; Verganti, 2009); also, by applying a systemic vision and environmental responsibility to design processes (Bistagnino, 2011; Battistoni et al., 2019; Barbero & Pereno, 2020).

Designers have become facilitators and mediators (Celaschi, 2008a; 2008b) of complex systems, that is, where individual factors intertwine with technological, economic-productive, socio-cultural,

and environmental factors, and have acquired a greater awareness of how to react, anticipate and “pro-act” to crises, in an attempt to transform critical situations into opportunities to generate positive impacts on people and the planet.

In addition to playing a relevant role as a creative activity that determines the technical, functional, and formal qualities of objects produced by industry, Design has thus evolved into a process that drives innovation and leads to a better quality of life through meaningful products, services, and experiences (Heskett, 2005; World Design Organization, n.d.).

Over time, Design has also embraced the criteria of Responsible Innovation (Owen et al., 2012; Stilgoe, Owen & Macnaghten, 2013; Blok & Lemmens, 2015; Gianni, Pearson & Reber, 2019; Jakobsen, Fløysand & Overton, 2019), thus taking on its own impacts and liabilities towards people, communities, and society (Succini & Ciravegna, 2022). As for environmental impacts, European Commission (2020) clearly states that up to 80 per cent of them are determined in the design phase of products; on its side, the Ellen MacArthur Foundation (2023) emphasizes the crucial role of multi-level design in the transition from our extractive to circular economy, proposing an adaptive and holistic design strategy.

The last decade has, indeed, seen the emergence of a wide variety of approaches to thinking rigorously and creatively about the long-term future. Among them, Advanced Design is an articulated system of design practices used to conceive and develop processes, products, or services for complex scenarios, seeking to produce continuous innovation and a long-term vision for society and organizations (Celaschi, 2015; Celaschi et al., 2019; Celi, 2015; Iñiguez Flores et al., 2014).

On the other hand, Transition Design (Irwin et al., 2015; Dunne & Raby, 2013) states that organizations, institutions, and communities must intentionally move towards a more sustainable, equitable and desirable long-term future by co-creating visions together with all stakeholders operating in the present, according to a principle of co-responsibility of all actors involved with respect to the impacts of a project. Transition Design is an approach characterized by some specific skills, including, for example,

the ability to devise solutions that integrate social and natural systems and to intervene sensitively in such systems; to devise solutions which take account of short, medium, and long horizons of time and all levels of scale of everyday life, and the ability to identify potentialities for transition in everyday life. (Irwin, 2015)

The Role of Design in Promoting Sustainable Transitions: A Choral Reflection

Within this framework, the challenge is therefore to encourage and facilitate transitions towards more sustainable and circular patterns of production and consumption, adopting a systemic and planet-centric approach, reinforcing the ethical responsibilities of design, and reaffirming its mediating role in the resolution of the wicked problems that characterize the contemporaneity. Researchers, educators, practitioners, and students from all over the world were invited for a choral reflection, to share their thoughts and

experiences on the design processes that lead to the disruption of traditional practices and the transition to alternative forms of thinking and action, with the aim of addressing current crises and laying the groundwork for a more sustainable future.

The results of this choral reflection are the contributions, collected here, which were presented during the 8th International Forum of Design as a Process “Disrupting Geographies in the Design World”, particularly within Track 1 “There’s No Plan(et) B: Sustainable Transitions to Systemic Planet-Centric Design”.¹ The papers can be grouped into four main thematic areas, each of which touches on a topic particularly relevant to the reflections promoted by the track: i) Collaborative Communities for Territorial Development; ii) Towards Planet-Centric Scenarios; iii) Circular Design Methods and Tools; vi) Materials Experiences.

Collaborative Communities for Territorial Development

In this first thematic grouping, the collected articles illustrate investigations and reflections on the role of design in supporting communities in collaborative processes leading to sustainable territorial development.

“Beyond Collaboration: A Network Analysis of Local Stances and Global Frameworks in the Collective Design of the City” is the title of the paper by Francesca Sabatini, Martina Massari, and Saveria Olga Murielle Boulanger, which focuses on collective city-building practices beyond the participatory framework of institutional urban governance, specifically examining how grassroots organizations in Bologna are able to produce a dual movement between local and global, mutually informing global movements and local practices geared toward sustainable city growth.

“Alter_Azioni” is the name of a teaching and research experience at the center of Pietro Costa and Raffaella Fagnoni’s contribution, entitled “Alter_Azioni: Designing between Biological and Artificial. Scenarios for a Short-Term Future”: this experience investigated the lagoon context as a framework for local design experimentation to address the problems of the local territory and the environment through the exploration of the needs of the region and its inhabitants, and in the search for a possible balance between the biological and the artificial approaches.

Finally, the contribution “(Systemic) Design for Sustainable Territorial Transition: A Literature Review of State of the Art” by Asja Aulisio, Silvia Barbero, and Amina Pereno, presents a systematic review of the literature in the field of design, and specifically systemic design, to identify tools and methodologies useful for supporting decision-makers or stakeholders in processes of social, economic, and environmental transition toward sustainable territorial development.

1

Track Chair: Erik Ciravegna, Pontificia Universidad Católica de Chile; *Track Co-Chair:* Clara Giardina, Alma Mater Studiorum – Università di Bologna; *Track Collaborator:* Davide Pletto, Alma Mater Studiorum – Università di Bologna. For more information, see <https://www.forumdesignprocess.org/dgdw22/sustainable-transitions-to-systemic-planet-centred-design/>

This thematic area brings together works by diverse authors, united by the intent to reflect on how design is evolving and how this evolution is leading to a paradigm shift and a holistic planet-centric transition.

Sabrina Lucibello and Carmen Rotondi, with their contribution “Dasein ist Design: An Ontological Discussion of Design in the Ecological Crisis Time” propose a reflection on the evolving nature of design and how it can stimulate new dialogic, reflective, and strategic approaches to face contemporary crises.

Annapaola Vacanti, Francesco Burlando, Isabella Nevoso, and Massimo Menichinelli present “The More-Than-Human Trend in Design Research: A Literature Review”, a discussion on design practices and approaches that, over the past decade, have evolved beyond a single-user focus and are thus defined by terms such as More-Than-Human Centered Design, Ecosystemic Design, Posthuman Design, Community-Centered Design, and Multispecies Design; the results of the literature review aim to provide a clearer picture of the phenomenon.

Through a methodology based on a tripartite analysis (literature review, case studies and historical context analysis), the paper “Being and Nature. The Aesthetic Ecocentrism” by Adriano Pinho and Francisco Providência, focuses on understanding how design aesthetics can take an active role in changing toward a more sustainable and resilient society.

Jurji Filieri and Elisabetta Benelli, with their contribution “Forward to the Primitive. New Sustainable Design Processes Characterized by Primitive Aesthetic”, emphasize how the growing integration of ethical and environmental sensibilities leads to an often-primitive approach to design that is capable of catalyzing concrete actions and triggering a new accessible aesthetic for the public.

Finally, Guilherme Giantini and Lígia Lopes, with their contribution “How Long Does It Take For a Paradigm Shift. A Design-based Critical Essay on Materials and Fabrication Processes”, offer critical reflection on the transformation processes of matter and energy in the production of human artifacts in design and architecture, with the aim of bringing out sustainable industrial approaches and promoting developments in potentially innovative fields, such as biomaterials and biomanufacturing.

Circular Design Methods and Tools

The contributions grouped in this area explore methods and tools, from both service and product design, to facilitate the transition to circularity in applications in specific fields.

Chiara Olivastri and Giovanna Tagliasco, in their paper “Sustainability Needs Service Efficacy”, focus on the area of service design and its contribution in the implementation process of a project called Efficacy, a platform for optimizing bulky waste collection and recovery of reusable parts through the Surpluse reuse and shelter centers.

“Systemic Design Applied to Medtech. Guidelines for Corporate Training on Sustainable Healthcare” by Enrica Ferrero and Giulia Ferrero illustrates how to use the potential of Systemic Methodology to define the contents of a training course on sustainability for the companies in the healthcare system.

Still in healthcare, Gabriele Maria Cito and Angela Giambattista propose the contribution “Reducing Waste in Healthcare: A Systemic Design Approach for Sustainable Disposables Manufacturers”, as a reflection on the application of Systemic Design methods to address the issue of waste management in the healthcare system, which plays a primary role because of its complex composition and risks to workers, patients, and the environment.

A discussion, in a systemic perspective, on how appliances should change to adapt to the current scenario of a compromised environmental situation and the need to transition towards a circular economy, is at the heart of Chiara Battistoni’s paper “A Framework to Design Appliances for the Circular Economy Scenario”.

Finally, “Digital Fashion Technologies & Practices: Design Driven Sustainable Transition in Fashion Industry” is the name of Ludovica Rosato and Alberto Calleo’s contribution, which addresses the environmental sustainability issues related to fast fashion and analyzes how, by exploiting technological innovation and the combination of tangible processes and intangible practices, design can support sustainable transitions in the fashion industry.

Materials Experiences

The papers of this fourth area take a specific look at the topic of materials and current experiments on both the creation of new materials and possible new applications of existing materials in a more sustainable way.

Michele De Chirico, with his contribution “Material Resources as a Contextual Complex System”, shows how the multidimensional interpretation of resources can lead to sustainable design actions; the article presents a mapping of the presence and use of material resources in local supply chains, to rethink their sustainable use through design interventions.

The paper “Diffuse Micro-Factory: Circular Distributed Production System for Microbial Nanocellulose” by Lorena Trebbi, delves into the details of an operational model, based on bottom-up and co-design approaches, for micro-distributed production of biofabricated materials, with the aim of suggesting possible circular alternatives to current linear production-consumption systems based on the take-make-discard paradigm.

“From Sea to Fashion. Seaweeds as Material for a Sustainable Transition” is the title of Paolo Franzo and Clizia Moradei’s essay, which addresses the reasons why fashion design is showing a growing interest in the marine environment as a context in which to identify new sustainable materials for fashion, focusing on the case of algae.

The contribution of Giovanni Inglese, Sabrina Lucibello, and Carmen Rotondi, titled “The Sound of Sustainability. Biomaterials and New Sensory Frontiers”, investigates the possibilities that design

research on biomaterials can offer to the development of musical accessories, in terms of “sensory enhancement” and spreading a new ethical consciousness around sustainability.

Finally, a sustainable application of materials is that proposed by Raquel Gomes and Cláudia Albino in their paper “Unpacking Ceramic History in Asia and Europe: Contribution to New Reusable Packaging Design”, which details the proposal for a non-disposable modular packaging system for ceramic products, which can organize interior spaces, thus reducing waste.

Erik Ciravegna

Ph.D. in Design from Politecnico di Milano. He is currently a Researcher at the University of Bologna; until 2022, he was an Academic at the School of Design of the Pontificia Universidad Católica de Chile, where he is now Visiting Professor. His research background is communication design, with a focus on packaging design, product identity and branding. He is particularly concerned with sustainability, ethics, and social responsibility of design. He also works on methods and tools to support creativity and project development.

Clara Giardina

Ph.D. candidate in Design from the University of Bologna. Her main research fields are sustainability and open innovation, especially in the packaging sector. She is coordinator of the Packaging Innovation Observatory (Unibo), an organization acting on the complexity of packaging to trigger transitional innovation. She looks at Responsible Advanced Design as a tool for creating sustainable behaviors.

Davide Pletto

Ph.D. student in Design from the University of Bologna. His doctoral research is centered on circular design in the packaging industry, aiming at finding more recyclable solutions without reducing the barrier properties that ensure product freshness and accessibility. In the area of circularity, he is particularly interested in issues related to materials and their sensory interaction, especially from a point of view of experimentation and prototyping.

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Beyond Collaboration: A Network Analysis of Local Stances and Global Frameworks in the Collective Design of the City

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Abstract

The research observes practices of collective city-making beyond the participatory framework of institutional urban governance. In particular, it looks at how grassroots organizations in Bologna are able to produce a dual movement between the local and the global, mutually informing global movements and local practices oriented toward the sustainable growth of cities. The first section introduces the theoretical framework, based on participatory governance, urban commons and grassroots networks; it presents the methodology in the second section, introducing the criteria for the dataset and the network analysis consisting of local and global nodes within the city of Bologna; it then presents the results of the analysis, discusses them and draws the conclusions in the final section.

Keywords

Grassroot activities
Collaborative governance
Networks
Urban economy
Urban design

The Shadows of Collaborative Governance: A New Framework for Looking at Collective City-Making

Multi-level governance has become a necessary modality of narrating, if not governing, the contemporary city by implementing participatory techniques. Born as a best practice in isolated stances (de Sousa Santos, 1998), a distinct stream of research on participation was already consolidated at the beginning of the century, identifying a taxonomy for the varieties of participation (Arnstein, 1969; Fung, 2006), with its potential and limitations. Participation was initially intended vaguely as the involvement (or validation) of citizens in the decision-making process concerning urban transformations (Cornwall, 2002); later on, participatory practices have been better understood as a practice of open innovation (Seltzer & Mahmoudi, 2013), introducing outer, if not divergent, inputs in the process of governing the city. A further specification was added when both urban planning tools and the scholarship that observed them started to acknowledge that participation was not to be understood only in the citizens-administration hiatus, but that intermediary bodies and other organizations, belonging both to the domain of NGOs and the private sector, were ideal partners in collaborative governance (Healey 2003). This became particularly evident (and a widespread practice) within the agenda for the sustainable development of cities and smart cities (Conti et al. 2019; Kalesnikate 2018; Pereira et al., 2018; Betsill & Bulkeley, 2006).

What has, however, been emphasized beyond institutional narratives and participatory scholarship is that citizens and grassroots activities can contribute to urban governance even when they are not actively engaged with the local administration (Cellamare, 2008; Castelli et al, 2011). Quite the reverse, grassroots movements are at the forefront of city making - i.e. of the factual production and reproduction of the city, of its spaces and its economy - an activity which often happens not only outside conventional spaces of “participatory practices” and “collaborative governance” but in open contrast to it.

The literature on the commons (Kornberger & Borch, 2015) have posited in most explicit terms by bearing reference to the collective processes of city-making as processes of “commoning” the city, i.e. of shaping the city by producing, reproducing, using its spaces and mechanisms as a shared resource (Stavrides, 2016). Here, citizens cannot be seen as isolated individuals but rather as cooperative subjects who self-organize themselves in more or less formal groups to enact practices in the urban space which, simultaneously, respond to urgent and practical contingencies and to a broader need to rethink the urban paradigm within a framework of sustainable growth. Through their interaction, they are able to strategize and build the capacity to alter the current urban paradigm (Schmid, 2021).

These phenomena have a twofold nature: on the one hand, they are localized and they operate in a tangible and spatially evident environment which articulates the nodes of the urban fabric (Orioli & Massari, 2023) - they are social centers, cultural organizations, and neighborhood committees, “intermediate places” (Massari, 2019) that offer informal services, share information, enable, produce local

agency; as hybrid governance configurations they often combine a societal vocation, cultural programming and political initiatives for the sustainable transition of cities (Sabatini, 2022), while contributing by both their actions and the imageries that they produce to enacting an “alternative city”, which opposes the current status quo (Morea & Sabatini, 2023). On the other hand, they are networked at both the local/national level and to broader national and international environments (Boulanger & Massari, 2022), producing a local-global feedback loop (Tsutsui, 2017). This loop has a twofold effect: it informs practices and more grounded actions at the local level, and it produces agency and reconceptualizes political frameworks at the global level (Maskovsky, 2020).

Eventually, this constantly updated, collectively produced body of knowledge seems to have the potential to adjust to the constant surge of urban crises in a more responsive way than institutional urban design tools, contributing to a sustainable model considering the interconnectedness to its nodes, its global outreach and its local-sensitive actions.

The present paper aims to observe how these collective phenomena, localized in the city, yet reaching out towards a broader framework, create a network of actors who shape concentric environments in the city (the cultural milieu, local decision-making committees, and activism) and contribute to the design of the city as a political, spatial, cultural and economic entity. Bologna is the focus of the analysis, and specifically the local and global networks of its grassroots activities.

The Context of Bologna and Its Challenges

Bologna represents an ideal ground to observe these stances for manifold reasons, which relate to the political temper of the city. The city holds a strong tradition of local grassroots activism on different fronts, covering the cultural sphere (LaTerra, 2021), labour rights (Chesta et al., 2019), civil rights (Heywood 2018.), sustainable food production and consumption (Alberio & Moralli 2021) and human/political rights (Bazzoli, 2021). Bologna is further characterized by a solid organization of the economic and social life based on sharing and cooperation: both the vibrant economy of the city and the grassroots political life are grounded on structured organizational forms which have, in time, consolidated the grassroots environment and the local economy; this occurred respectively through cooperatives, co-owned social enterprises (Selloni & Corubolo ,2017), and *centri sociali*, dissident political collectives operating in spaces often illegally appropriated (Mudu, 2004). From an institutional viewpoint, the city has been responsive towards this collaborative ecosystem by deploying political actions such as Neighborhood labs (Dalfovo, 2020) and the Regulation for the Care and Regeneration of the Urban Commons (De Nictolis & Iaione, 2021). At the transnational level Bologna, with the dense knowledge economy generated by the University and its paramount number of temporary inhabitants, is crossed by a dense flow of human and social capital where the local and the global dimension intertwine.

Within Bologna's political, sociocultural and economic ecosystem, frictions exist between collaboration and cooptation of local citizenship, as the Municipality seems to be less responsive to radical stances of transformation than to those embedding its own political agenda (Giannini, Pirone, 2019). This scenario requires the understanding of what the grassroots organizations' contribution to collective city-making is, and how this is enacted through local and global network.

Method

The research has produced a database of the grassroots organizations operating in the city of Bologna, and has analyzed their interactions through network analysis, carried out with the Cytoscape software.

The first step in constituting the dataset was conceptual: the theoretical framework and the research question contributed to framing what organizations to include in the quest. Their major feature would be that of having societal aims, regardless of their field of action (be it that of food production and consumption, of education, of artistic practices, sustainable lifestyles, and so forth). Strictly commercial organizations, though part of a creative ecosystem which contributes to the overall grassroots economy, were excluded from the mapping.

To identify the organizations operating in the Bologna environment, triangulation of different sources was used: first, institutional registers were investigated where the major typologies of organizations are recorded: *Circoli Arci*, *centri sociali*, cultural associations, social cooperatives. Second, exponential discriminative snowball sampling (Yadav et al., 2019) was used: snowball sampling consists of interrogating an initial sample (in this case the registered organizations) until it reaches saturation, i.e. until all objects having an existing connection to the other sampled objects are, in turn, sampled. Discrimination was used in snowball sampling so as to exclude those organizations that had a solely commercial purpose. This step allowed to include in the sample the organized yet unrecognized groups of activists, collectives, and organizations that are not formally recorded in institutional registers, and to identify organizations that were external to the Bologna context.

The dataset was then articulated to include the geographical position, the nature and the activities of the organization. The activities, extracted from the organizations' social and web pages, contributed to articulating a taxonomy of grassroots initiatives and contributed to the clustering illustrated in Fig.1. Once the dataset was created, a third step consisted of looking at the organizations' interactions. As said by Castro-Martinez et al. (2022: 74), "since the activities in the [symbolic] sectors are often developed within a project framework, interactions differ from project to project". Therefore, in order to properly map these interactions, the research did not gather information about the network from the organizations' webpages, but from their communication channels, analyzing their project collaborations within the past 18 months. Nodes were then differentiated by geographical location and divided into "Bologna, Region, Europe, World" categories.

The research constitutes an unprecedented mapping of city initiatives at the grassroots level and their transnational interactions. Yet, it presents some limitations: first the sampling needs refining – for instance, there are many organizations that engage in multiple collaborations with one another over the year but the weight of such relationships is not accounted for; many of the mapped organizations did engage in collaborative activities with formal institutional actors; while the object of the research was the identification of grassroots network, institutional cooperation might indeed play a role in the ability of an organizations to be central to the network, and further research is needed to identify these power dynamics. Another possibility for future development is the analysis of the spatial distribution of the organizations in the city, looking at the type and nature of organizations through the lens of their position in the urban space and at the activities they enact. A semantic and thematic analysis of the organizations' actions, together with some fieldwork, would produce insights into the process of mutual information of local and global levels.

Findings

A total of 94 organizations and 445 interactions were mapped.

A prominent number of organizations are artistic NGOs, cultural associations and collectives working with different media and methods, with a major focus on the performing arts – all these activities are carried out with the distinct aim of creating relationality and social inclusion through artistic practices. The second largest portion of organizations has been labeled as “green transition and sustainability”, under which are recorded the organizations promoting a different paradigm of the city, featuring sustainable mobility and new sustainable systems of resources production and consumption (from food to energy). *Centri sociali*, which usually act on the verge of illegality, have been placed in this category in light of their involvement in alternative commercial circuits that support degrowth or sustainable growth, from local food markets to upcycling and recycling.

Multifunctional spaces cover yet another significant portion of the grassroots ecosystem: they are social centres, cultural centres, multifunctional spaces and ‘third places’: “intermediate places” (Massari, 2019) where cultural, social and mutualistic activities can be performed simultaneously. These spaces often belong to the historical fabric of the city, have a long-standing tradition, and often welcome a very diverse range of users, from students in after-school to elders and temporary residents.

Education, intended as lifelong learning and as an activity for social inclusion, is also covered by several organizations – a choice was made to place here the organizations that mostly deal with book exchanges and presentations or publishing houses for children as a form of education.

Other organizations deal with social inclusion, intended both as creating cohesion, shared understanding, common practices in communities and as the integration of migrants; traditional as well as innovative crafts (mainly fostering cooperation and integration) are also present, while many deal with women's rights and anti-violence initiatives. Two organizations were able to create clinics which address health rights of vulnerable and marginalized groups.

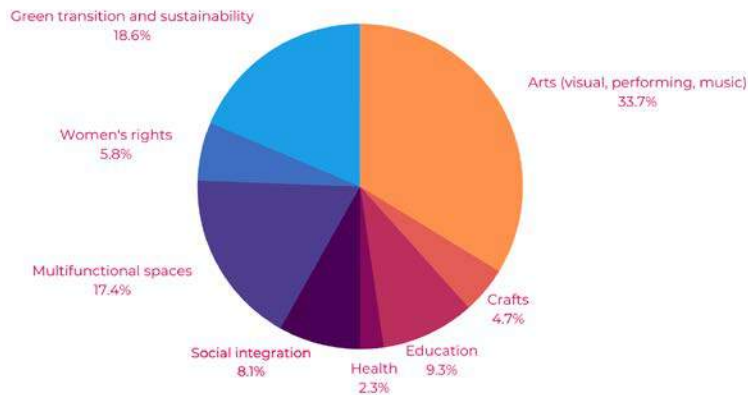


Fig. 1
The grassroots ecosystem articulated by type of activity.

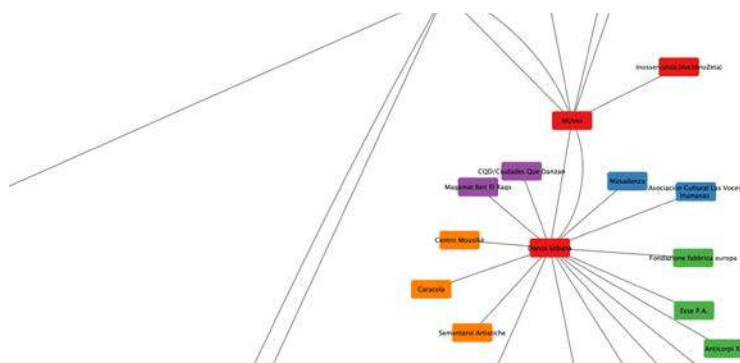


Fig. 2
The network analysis of the grassroots organizations and their interaction with the local, regional, national and european environment. The red nodes represent the Bologna organizations, whereas the orange ones are the organizations active in the Emilia-Romagna Region; green marks the Italian organizations, scaling up to the blue ones (Europe) and purple (world).

The organizations of this ecosystem are tightly interrelated to each other and to a broader transnational ecosystem. Some insights are presented here that illustrate how networks are articulated, structured and clustered according to the organizations types introduced in Fig. 1.

Cultural organizations show a structured and dense network which distributes, quite predictably, in an uneven way: larger artistic organizations are more strongly correlated to numerous external international organizations (*Danza Urbana*, *Camere d'Aria*, *ArteMigrante* among others) and, even though the present paper did not account for these ties, are likely to have a strong interaction with institutions. Here, a strong exchange of cultural capital is visible, and the ambition to update expressive languages in the light of emerging European and global trends. Minor organizations, which are additionally focused on community initiatives and area-based development, engage in a dense network at the local scale. What is interesting, however, is that their network is more diversified, as it involves social cooperatives and NGOs with a societal focus which, by engaging with them, aim at fostering social inclusion and dialogue through the arts (*Circo SottoSopra*, *Dry-art*, *EtaBeta*, *Fraternal Compagnia*, *Laminarie*). The two levels, however, cannot be entirely disentangled, as the two network structures meet in areas where the lower and the higher level of cultural production exchange practices and share spaces - as is the case with the centre *DAS*, *Dispositivo per le Arti Sperimentali* or the cultural spaces who have entered the Trans Europe Halles network.

Informal organizations, political collectives and associations of social promotions are, in their turn, tightly correlated: a dense network exists between collectives promoting grassroots political actions and protests (as is the case of *Centri sociali* such as *Làbas*, *TPO*, *Vag61*); organizations proposing new systems of food production and/or distribution to fragile groups (*Campi Aperti*, *Cucine Popolari*, respectively “Open Fields” and “Popular Kitchens”); associations organizing health services for those who do not have access to basic healthcare. The local network, operating in a diffuse way within the urban fabric, is corroborated by interactions with organizations having mostly a European reach and which aim at similar goals, such as *Noname Kitchen*, supporting people on the move with food supplies, and *Mediterranea - Saving Humans*. Similarly, women rights collectives and organizations show particularly intense cooperation with actors at the National and European level, activating initiatives which are embedded in international rights’ networks (*Global Network Shelter Forum*, *Women Against Violence*, respectively at the Global and European levels). A robust network of organizations operating in the domain of sustainable mobility exists mostly at the local level, often sharing spaces and goals with political collectives.

Besides the existence of some isolated network of cultural organizations or minor neighborhood associations, which appear at the margins of the network analysis, what is evident is the interconnectedness of levels which, though clustered into denser networks, contribute to overcoming the view of grassroots activities as sparse, and identifies a distinct grassroots level of urban governance and collective city-making which, according to the typologies indicated in Fig. 1, act in common to produce behavioral changes for more sustainable production and consumption modes, for low-carbon mobility concepts, and for social cohesion, with a robust contribution from the arts and cultural sector.

Discussion & Conclusion

Effective responses to urban crises “depend on successfully integrating ‘universal (scientific) knowledge with knowledge particular to the social, ecological, and historical circumstances of particular places’” (Gollagher & Hartz Karp, 2013: 2346). What emerges is that the Bologna grassroots ecosystem operates within a very dense network of interaction on several levels, which seems dependent on the size of the organizations and, to some extent, on its scope. The impossibility to disentangle the two levels and to identify distinct ones testify, however, for a dense interaction between local practices and transnational frameworks. This is particularly evident in the ecosystem of NGOs and political groups whose activities are grounded in the spaces of the city, and whose actions have practical implications in the life of its dwellers, especially those living at the margins, not having access to healthcare or food, or a proper shelter. This action is highly coordinated, embedding mutualism and the complementarity of actions which end up resulting in a coherent, patterned and networked practice of city making. As said by Schmid (2021: 202), “patterns of practices can catalyze spaces for grassroots governance. Practices which built relations that are conducive to

further transformative activities enlarge the spaces for alternative economic and political relations”.

These organizations, while engaging with a local struggle for a more sustainable and accessible city, and in shifting the economic paradigm towards sustainable growth, are simultaneously acting in partnership with other major global or European organizations (in most cases even bypassing the National level) by which they are informed and which, in turn, are informed by their actions. This produces a twofold movement between political practices and concepts aimed at making cities sustainable from a social and environmental perspective. This generates a loop between the local and the global, where “global human rights first transform local actors’ movement actorhood, which concurrently shapes their goals and strategies, and then provides political opportunities to propel the movements into new activities.” (Tsutsui, 2017: 1092). Within this perspective, such initiatives appear to be “sustainability transition pioneers” (Gernert et al., 2018), operating at the forefront of open innovation for environmental justice and the ecological transition.

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Alter_Azioni: Designing between Biological and Artifactual. Scenarios for a Short-Term Future

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Abstract

The contribution describes the activities of a teaching and research experience, named *Alter_Azioni*. It consists of three main parts. Firstly, it introduces the lagoon context as the reference framework used to experiment with a design local based to address the problems of the local territory and the environment. The paper moves on to discuss the design approach proposed to the students, contextualizing research and experiences based on the needs of the region and its inhabitants, through the exploration of a possible balance between the biological approach and the artifactual one. Furthermore, it summarizes some references about these issues, in order to gain a deeper insight into the chances or the pitfalls of this project. The second part provides an overview of the possible design range of concerns scenarios for a short-term future, focusing on the design projects developed and mapping them following three paths. Finally, in the third part, a look back points out what has been experienced as possible alternative scenarios.

Keywords

Design for social impact
Design for fragile environments
Product-service system
Service design
Proximity relationships

Scenario - the Venetian Lagoon

The reference scenario for this paper is the Venetian lagoon, a vast territory with a surface area of approximately 550 km², of which approximately 130 km² is made up of islands and terrestrial land, and the remaining 420 km² is made up of bodies of water (Maticchio et al., 2017). This is an area that is, by its very nature, mutable and in constant transition between land and water, in which it is possible to experiment and explore new possibilities for research and design projects. In this context our interest has shifted towards systems of things in which aesthetics and poetics are brought into play to load 'nature-based' solutions with expressive potential, suitable for the survival of very fragile situations, going beyond approaches and strategies of the design project based on functionality directed principally at the industrial system. The experimental aspect consisted in driving the students to analyse different circumstances of a local context, a very particular territory such as the Venice lagoon.



Fig. 1
Lagoon of Venice: a fragile environment. Ph: Giorgio Bombieri.

This area represents a wealth of biodiversity, landscapes, culture, and history, which is not comparable to other coastal areas of the Mediterranean basin (Zanetti et al., 2007).

The Venice lagoon is an emblematic and successful example of the interaction between man and nature, which contrasts the slowness and apparent unchanging place with an extreme fragility due to the unstoppable rapid transformation of the ecosystem, the unresolved issues related to climate change, the human intervention too invasive and short-sighted. Among the causes of the deterioration of this territory, of which only 8% consists of dry land, prevail the issues of sea-level rise and wave motion, large tourist flows, trawling, isolation of small villages with a rich cultural heritage, water pollution, microplastics, alteration of flora and fauna with the consequent loss of biodiversity, the progressive weakening of craft economies. The apparent immutability threatens to be disrupted by the quickness of the traumatic effects.

Beyond the constrained and traditional paths of industrial design, these urgencies impose the need for a strong and rapid push exploiting the design capabilities to imagine and build possible futures. In fact, this project started with the idea of facing the complexity of the lagoon ecosystem by inviting students to research specific local situations - social, cultural, environmental - through collaboration with local stakeholders to imagine scenarios of daily life for a short-term future. The primary objective was to highlight possible chances for the sensitive nature of this environment, testing with the students a different way of conceiving and managing the design skills, tools, and processes. Young designers were asked to contribute to the collective process of social innovation (Manzini, 2015) for the quality of life in vulnerable areas such as the Venetian lagoon.

Reorienting the Design Approach Between Biological and Artificial

The *Alter_Azioni* project focuses on a specific region and the people who live in it, their needs, and their behavior, aiming at the heart of a problem in order to foster new visions and generate ideas capable of influencing the lagoon context: a shift from designing forms, spaces, services, and artifacts, to conceiving a way of being and living.

Increasingly frequent critical emergencies on an environmental, social, political, and economic level bring into focus the need to rethink the dynamics of the production system and distribution of goods, pushing design to interrelate with the local territory or a specific context in which to develop circular and proximity relationships. Driven by a responsible vision, the project deals with the most critical issues of everyday life, and, beyond form-related features, aspires to content (Papanek, 1971) with a greater focus on semantic and cultural aspects, in relation to history and traditions, relationships and feelings, using tools and a more empathetic language (Fagnoni, 2012). As Paolo Cardini states, design can be considered “an endogenous act, that lives and grows in specific contexts, rather than being an exogenous element implanted in existing systems with a high risk of rejection” (Cardini, 2022, p. 17).

In this framework, design is not a goal to be achieved, it's not the design *of* something, a form-oriented investigation, but rather the design *for* something, as a medium to bring about changes that have a positive impact on society and the environment. In this way, the design tools and approaches are applied to intervene in changing a specific situation, or, quoting Herbert Simon, to “devise courses of action aimed at changing existing situation into preferred ones” (1969). The concept of *designing for* something has become established especially since design has started to expand from the design of tangible things to the design of services, experiences, and processes (Sangiorgi, 2011).

Meanwhile, designers have begun to spread new conjunctions of design in areas aimed at the social, the commons and the environment: *social impact design*, *socially responsible design*, *design for social innovation* (Resnick, 2019), recall the connection established by pioneers such as Papanek, Maldonado, Yona Friedman, between design, ecology, and social development. This has

brought to the attention of designers those instances of the research for an ethical and sustainable design path – as opposed to a vision aimed exclusively at commercial purposes – that has been spreading since the 1980s through those participatory and responsible practices. Emanuele Quinz (2020), in his late book, talks of design as an anti-industrial project.

After all, as Manzini points out, most of the problems people face lie in proximity (Manzini, 2021). Relationships develop within a given context understood both as a physical space and as a social form in which action becomes possible and the project takes on meaning. The system of constraints and opportunities that are proposed, the possibilities for action, also need to be repositioned in proximity, going to strengthen the thickness of the social fabric, operating in the hybrid physical-digital space.

Therefore, the pursued approach combines the humanistic and sensitive dimension of design with the technical-scientific perspective that regulates the way of working.

Through an osmotic process of micro-actions, which connect and establish rhizomatic relationships (Deleuze & Guattari, 1980) the design processes and tools are used aiming to sensitively reunite the individual with the surrounding everyday reality.

Designers who “shape a design space in which non-specialised users can access user-friendly environments in which they can design their own objects” are defined as meta-designers by Jos De Mul (2011). The transition from designer to meta-designer means allowing a passive user to evolve into an active agent of change that overcomes limitations and problems with endemic and endogenous solutions (Cardini, 2022)

Back-Casting

Already in 1998 John Tackara in *Domus* magazine (1998) clearly analysed futuristic visions for the design of 2028, talking about entropy and seeing how design was already able to detach itself from industry and also innovation. He also talks about *back-casting*, a project path that aims at processes rather than products, investing more in the collaboration and the integration of skills and disciplines, to arrive at imagining concrete opportunities and new directions for design.

The *Alter_Azioni* project works on 16 products-services, actions able to stimulate reflection and address specific behaviours, rather than defining the materiality of the products, to recover an increasingly limited social imagination (Mulgan, 2020). The ability to conceive great technological developments and futuristic scenarios and the progressive blurring of the boundaries between human and artificial are diminishing the capability to react even in front of the prefiguration of apocalyptic visions (Latour, 2018; Morton, 2018; Staszowski & Tassinari, 2021).

Rapid evolutions in digital technologies have transformed production processes and information systems, and the dematerialization of products has changed the way we consume, work and travel, offering alternative experiences and creating new collaborative market logics in which services or product-services take the place of traditional goods in a perspective of innovation by meaning

(Verganti, 2018). The primacy of servitization (Siagri, 2021) indicates that the raw material of the economic and social system may now become sharing and collective intelligence (Mulgan, 2018) in the context of a different function of territories, no longer considered as matters of mere extraction of materials and energy or support for industrial settlements, but as evolving intangible assets (Siagri, 2021).

Alter_azioni: Designing Otherwise

In this time of the extreme present in which everything can change in a very short time, there are things and circumstances that seem to remain unchanged and unchangeable, such as the lagoon. The term *Alter_Azioni* refers to a different way of approaching design. In this combination of words, *Azioni* (*Actions*) relates to design acts and interactions between place, people and peculiar circumstances, the aim of which is to design starting from the priorities of the geographical context. In its turn, the term *Alter* indicates the *otherness*: related to the Venice lagoon this term investigates the concept of *other* and refers to a pluriverse (Escobar, 2018), a system in which it is possible to rethink other ways of moving, caring, feeling a sense of belonging, and preserving. When considering the pluriverse, we expand the horizon of our perspective, recognizing and appreciating the multiplicity of realities co-existing. Each reality within this pluriverse, holds unique interactions, dynamics and ways of living which inspire alternative design practices. These universes propose a multitude of potential, encouraging a shift away from a singular, dominant perspective to a vast array of interconnected realities.

This approach encourages young designers to focus on an in-depth research phase with an ethnographic and geographical field analysis, which supports and guides the different stages of the design process. As a consequence, it follows the Double Diamond design process model of the British Design Council, which has been adapted for this specific context.

In the first divergent part of the design process, it was essential to carry out some preparatory exercises using visual collaboration platforms and guided brainstorming sessions, to identify some characteristic aspects of the target territory, even in a preliminary way. Subsequently, the students were engaged in creating a postcard on a subject that had particularly impressed them, such as biodiversity, recovery of local craft traditions, and conservation of natural heritage, with the aim of understanding a possible approach to such a specific context. A key stage is an on-site investigation, when the students carried out an exercise called *Video Personas*, which had a twofold purpose: on the one hand to collect valuable information directly on the place, using the ethnographic approach typical of UX design and service design, and on the other hand to move in a real context and experiment with design as a tool to perceive social impact, contextual reality and proximity relationships in a direct way. The *Video Personas* become in this way a design artefact.

With this approach it was possible to identify some situations that were unknown to the students, through personal confrontation with some people found on site (e.g. the elderly farmer who grows

vegetables on the island of Sant'Erasmus, the CNR researcher who is an expert on algae, the chef who only uses local raw materials from the lagoon area, the foreign tourist who arrives in Venice for the first time and has to plan his timetable, etc.) with the aim of identifying for each of them needs, desires, habits and cultural backgrounds.

Compared to the already well-known Personas tool, the use of video offers different information: "The video supports empathy, engagement and understanding of the character, it communicates the softer details on behaviour, action and motivation and creates curiosity" (Nielsen, 2013, p. 78).

Through the video interview, the student is no longer forced to design by imagining the world in its most global and abstract dimension but enters a direct relationship with the real context, with the people who inhabit it, their stories, and their work, establishing a deeper and more authentic knowledge process.

During the following phases, design projects have been developed, enabling students to gain experience, making their proposals take shape, using local materials and realizing study models, with the help of local stakeholders. Some of them will be carried out with local associations, others received some funding and prize, others probably could be involved within the framework of the post initiatives of an Interreg project (<https://www.italy-croatia.eu/web/crew>) on the local development of the Venice lagoon.

Three Paths for a Short-Term Future

The *Alter_Azioni* activities and design projects aim to take care of the place, be rooted in the local context, and feed circular processes. Starting from the research work and design experiences three trajectories can be classified, useful to identify possible directions of the design role in the contemporary context.

Bio-Based and Second Life

This path includes bio-oriented projects that experiment with natural materials approaches, that enhance local products, crafts, activities, and their related contexts.

A critical emergency in the lagoon is the progressive erosion of the salt marshes, which endangers the survival of the lagoon and its inhabitants both physically and culturally. Addressing these problems, the project *Pitàro* is a product-service system that involves people in a community and collaborative action aimed at the environmental restoration of salt marshes. It allows people to grow halophyte plants at home, with the purpose of replanting them in salt marshes.

Another design proposal considers that Venice has the potential to become a benchmark on the topic of seaweed. Therefore, *Tressa* is an open-source product-service for the collection and reuse of algae, a fundamental natural element for the fragile balance of the lagoon ecosystem, but at the same time a versatile material in its adaptability of use.



Fig. 2
Tressa, a project for algae.
 Collection, information,
 witnessing through
 products-services. @luav
 Alter_Azioni Lab Design 3.



Fig. 3
Pitàro, a proximity sharing
 service for a community
 and collaborative action
 aimed at the environ-
 mental recovery of salt
 marshes (barene). @luav
 Alter_Azioni Lab Design 3.

Traces and Experiences

This path includes projects related to local traditions, which recover stories and knowledge of crafts, places, rituals or ways of life that are in danger of disappearing.

One example is the tradition of pearl manufacturing: since the 13th century pearls have been used as currency, but it is only since 2020 that the know-how related to this long-standing knowledge has become part of the Unesco heritage. The *Contatto* project is a product-service system that offers an experiential tour in the Venetian Lagoon to raise interest in the art of Venetian pearls.

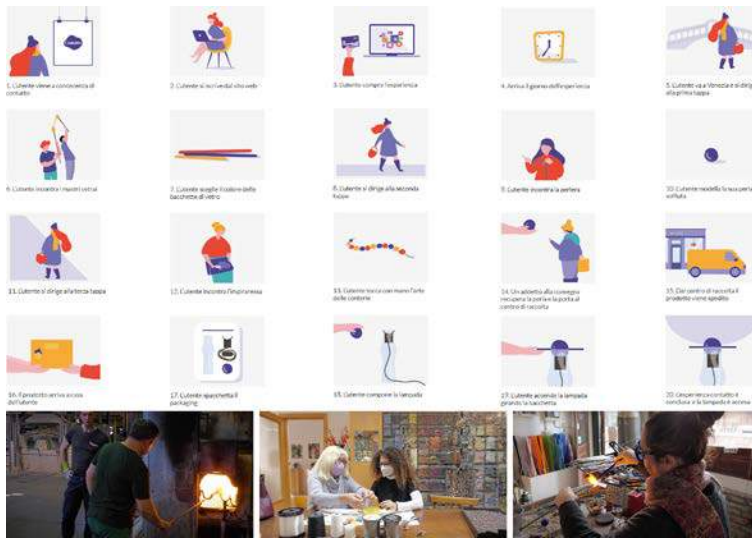


Fig. 4
Contatto, an experiential tour that guides people to the art of Venetian pearls.
 @luav Alter_Azioni Lab Design 3.

Habits and Welfare

This path includes projects that aim to facilitate the maintenance of lifestyles and habits, seeking a balance between the distinctiveness and image of the lagoon, and the needs of its inhabitants.

In the lagoon the problem of travel between the city and the islands is real and urgent, on the one hand because of the huge influx of people and on the other because of the complications involved with the use of public transportation. *'Ndemo* is a special boat pooling service accompanied by a set of products (pinpoint, raincoat, and seat) that allows the best possible use of private boats.

Another problematic aspect is the lack of care services: many islands have no pharmacy, forcing residents to make very long and difficult journeys to purchase medication: *Medice* is a product-service that consists of a communicating system composed of hubs, drones and a mobile app and it has been designed to integrate the existing pharmaceutical service system.

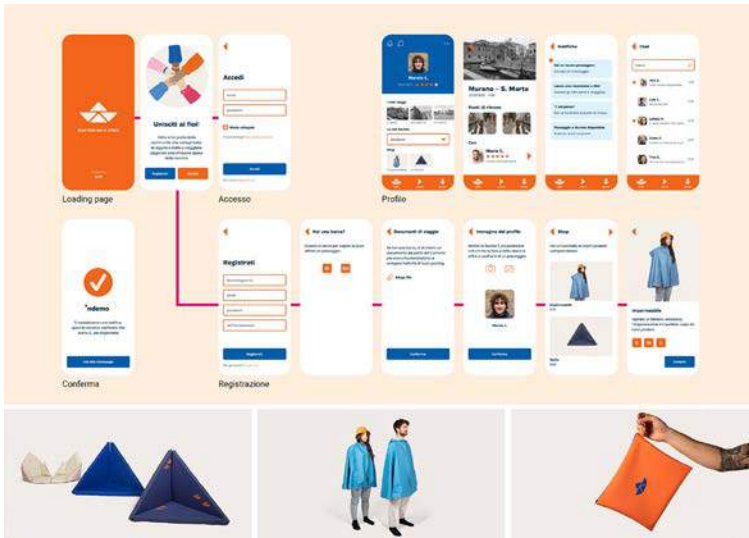


Fig. 5
'Ndemo, a boat pooling service to facilitate movement in the Lagoon in an economically and ecologically sustainable way. @luav Alter_Azioni Lab Design 3.

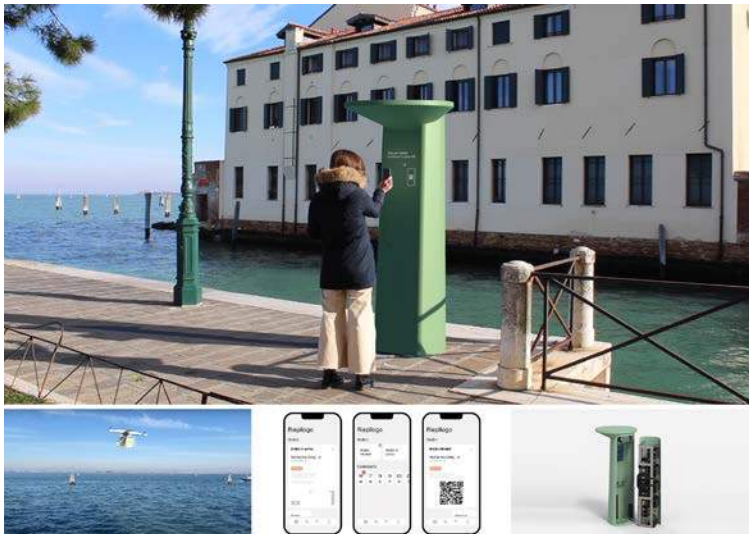


Fig. 6
Medice, a product-service system for health to improve the pharmaceutical system, with hubs scattered around the lagoon and drugs transported by drones. @luav Alter_Azioni Lab Design 3.

The aim of these projects is to go beyond the academic exercises centered on theoretical tasks, fostering practical experimentation in the development of personal projects in collaboration with local stakeholders. This hands-on approach is exemplified in *Tressa* project through the prototyping of a bioceramic and a bioplastic film derived from algae. These materials have been used to create a set of tableware, underlining an emerging trend in the use of second-generation materials. Similarly, *'Ndemo* project resulted in the development of a service and the necessary artifacts for its operation, also participating in the incubation process as a startup.

Changing Design Paradigms

In a world of ever-increasing emergencies related to climate change and pollution, it is not possible to continue with the idea of design feeding the global commodity system (Rawsthorn, 2018). Instead of seeing design as the production of goods and commodities, it needs to be understood as the making of what is necessary for sustaining the environment.

If the aim of design discipline is to improve people's life, today we need to think about maintaining and protecting the habitat in which they live.

We are facing a momentous change: an unstoppable process of social and environmental ruin puts us in front of the faults of the previous ones. The young generations of designers are much more sensitive to these issues: they feel anger towards those who preceded them thinking without any scruple only about their interests (Fagnoni, 2021). In this sense, as educators, we try to make experiences with our students to imagine a different approach to our disciplines: how to apply design skills and tools to contribute to the maintenance of the fragile local habitat in which we live.

Fundamental to this project is the idea that designers need to consider designing as/for the common goods (Botta & Jungiger, 2021) and consequently the commons, not only as a matter of result but as an attitude (Rawsthorn, 2018), testing a process in an experimental way, to finalise an *alter* way of conceiving and developing product-service systems.

Following the outlines of a post-digital craft, a long time after Sennett's book success (2008), good hands have regained vigour, although electronics, computer science and artificial intelligence dominate and dematerialize customs and traditions. The "good hands" (as they are virtuous, technically skilled) are also "good hands" (as they are polite, doing right). These practices recover the culture of proximity between the local workers, the local economies, and emerging designers (Fagnoni, 2021).

The mapped three paths address the *environmental* sense of design, offering a contribution to the ecological concerns of human cohabitation within a biosystem and taking care of the making of a relationship system.

In order to address these needs, the design process experimented in the *Alter_Azioni* project was based on a multidimensional design: it includes projects of services, products, installations, actions, and participatory practices, characterized by a commitment to activate social transformations and improvements of the existing environment oriented towards the common good, citizenship, sustainability, and accessibility. The process starts from a careful analysis in the field, experimenting with methods to reconstruct a representation of reality: video interviews carried out on the territory are a concrete example of this. They do not represent a mere ethnographic and documentary investigation phase, but are intended as an artefact, constituting the story designed for and with local stakeholders, the recipients of the interventions, in response to increasingly pressing social and environmental needs. These video interviews gave origin to the product-service systems described above.

Some steps underpin this paradigm shift: the first one is based on the importance of using local materials, rethinking production as an environmentally friendly system, and introducing an experimental approach through the re-circulation of natural waste. The second gives importance to the enhancement of territorial heritage through the recovery of rituals, gestures and actions related to objects, artistic and craft products, foods, memories, and places. The third process focuses on the primacy of servitization, considering sharing and collective intelligence as the raw material of the economic and social system for a different balance of territories resources.

The challenge is thus to promote and support the shifts towards sustainable habits and practises. This is possible by adopting a systemic and planet-centric approach, strengthening the ethical approach of design, by reactivating and re-enabling its role in tackling the wicked problems that distinguish our time through focusing on the hyperlocal context.

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(Systemic) Design for Sustainable Territorial Transition: A Literature Review of State of the Art

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Abstract

Sustainable territorial development is one of the crucial elements of most governmental strategies and action plans at the international level, which have to adapt to the local context in which they are implemented. In its different scales of application, the discipline of Design is increasingly called upon, permeating skills and tools within policy and governmental contexts that contribute to the definition of strategies to address complex problems. This paper presents a systematic literature review to map the specific declinations of the design field, with a closer look at the disciplinary areas close to Systemic Design methodologies, which are most involved in this field of research. The emerging tools and methods aim to support decision-makers or stakeholders in a necessary social, economic, and environmental transition process.

Keywords

Systemic design

Literature review

Sustainability transition

Territorial development

Introduction

As stated in the 'Beyond Net Zero: A Systemic Design Approach' Report by the Design Council (2021), "*We are facing an enormous challenge in dealing with the climate crisis. Despite promises and good intentions across the globe, we continue to see increasing emissions, environmental pollution, and rising inequality.*" (p. 5).

Also, COP26, the 26th United Nations Climate Change Conference, has further stressed the difficulties and lack of cohesion in defining solid strategic objectives. In particular, for the substantial change in climate mitigation actions and sustainability of our socio-economical models, that should be fair and indeed sustainable for all the places in the world. Moreover, we live in a highly interconnected world. Still, relevant decisions on reversing course to tackle climate change often consider the economic needs of the population inhabiting the world's most developed parts. However, the worst problems in underdeveloped or developing contexts are dictated by ever-increasing actions or demands from the countries that define the fate of the global economy. These challenges can be defined as "*wicked*" (Rittel & Webber, 1973), as they are complex, ill-defined problems that traditional problem-solving methods cannot solve. Nowadays, designers are asked to face what Donald Norman and Pieter Stappers call *complex socio-technical systems* (Norman & Stappers, 2016) that should be addressed from a systemic perspective, considering the needs of the planet, as a system, in a more-than-human perspective (Gaziulusoy *et al.*, 2021). Since the global pandemic of Covid-19 and today, with the current conflict between Russia and Ukraine, the fragmented way the phenomena happened in other contexts were previously observed, perhaps far away from where we live, is beginning to change. The global challenges are to be considered transnational in nature and trans-institutional in solution. They cannot be addressed by any government or institution acting alone. They require collaborative action among governments, international organisations, corporations, universities, NGOs, and creative individuals. Moreover, this fragmented view must also begin to be overcome regarding climate change issues. It is, therefore, necessary to enable a vision that emphasises the interconnectedness that has always existed. As James Lovelock 1979, with his Gaia Theory and the Club of Rome researchers, predicted within the *Limits to Growth* in 1972, people began to realise that more sustainable and joint action is needed to avoid an irreversible disaster (Lovelock, 1979).

Design as a Contribution to the Global Sustainability Transition

These preliminary remarks lead us to consider the role that Design, both as a discipline and a practice, can play in dealing with such disruptions by influencing behaviours, managing complex systems, and promoting sustainable production and communication processes. The Design discipline has always been influenced by multiple other fields, from hard science to humanities and social sciences. Afterwards, influence has become the ability to mediate between parties

(Minder & Heidemann, 2018), and this led design to interact with different stakeholders and diversify its fields of action. Meanwhile, as a tangible example of the process mentioned above, during COP26 in Glasgow, it took place *Design For Planet*. The first edition gave the stage to visionaries across the Design field, who are leading in sustainability and climate action, and who aimed to support decision-makers to prioritise the well-being of our planet in their work.



In addition, the Ellen MacArthur Foundation, one of the prominent non-profit organisations dealing with the Circular Economy, took part for the first time in a COP to provide the expertise and information gained over the years. It pointed out that 45 % of emissions are associated with producing goods like food and consumer products (Ellen MacArthur, 2021). This stresses the profound relationship between Circular Economy and Design, thus highlighting the need to redesign production and consumption systems to make them regenerative, capable of exploiting the connections generated within a territorial system and together with the people who live there and govern it. Within this framework, governments must understand that national Circular Economy and climate plans cannot be conceived as separate entities (Barros *et al.* 2021). Innovation, wise management of material flows, new business models and cultural shifts can reduce costs and dependence on raw materials and reduce emissions and environmental impacts. This paper shows the connection between the attention to the local context regarding sustainable development and the role of design by merging levels of complexity Fig. 6 addressed by the discipline. Specifically, the PhD's research highlights how Systemic Design creates mutual relations between people, value chains, and resources of a territory, aiming to enhance local cultures and generate development and collective well-being through a *glocal* perspective (Persson & Erlandsson, 2018).

The Evolution of Design as a Discipline. The Fundamentals of the Literature Review

Over the past decade, Design has been committed to offering support as a technical, creative, and participatory practice with various problem-solving tools to be used and shared. These tools are helpful and strategically adopted in tackling challenges involving the stakeholders through a bottom-up and participative approach. One of the aspects already mentioned in a *The Guardian* article in 2013, which referred to the Design Council's work: "By doing research and running workshops with local people, the designers were able to tackle some of the causes of major frustration and confusion for residents and the council" (Design Council, 2021). If we add to the technical and creative elements of design the ability to interpret, visualise and understand complexity, we are dealing with Systemic Design. This is recognised for its ability to address and understand complex and uncertain problems. This aptitude could significantly contribute to strengthening the criticality of the multi-level sustainable development process.

Furthermore, Systemic Design practices have developed co-creation approaches that integrate social systems principles to guide stakeholder design for complex systems (Jones, 2018). This paper presents a systematic literature review that aims to understand in which niches Systemic Design and other Systems-Oriented disciplines have become embedded to support the definition of new strategies at the personal and public levels. The research is part of the first year of the doctorate path and concerns the role of Design (with a focus on Systemic Design) for a sustainable territorial transition. An additional guide is made on what could be the initiatives and action plans related to Circular Economy practices as a driver for local, sustainable development. The latter is an area of interest throughout Europe and internationally. It is essential to underline that nowadays, also thanks to the funds of the 2021-2027 financial framework and the recovery plans from the Covid-19 pandemic (Fig. 2), there are many projects and research which are addressing sustainable territorial development, and many of them relate with Design methods and decision-making processes, especially regarding sustainability and sustainable transition.

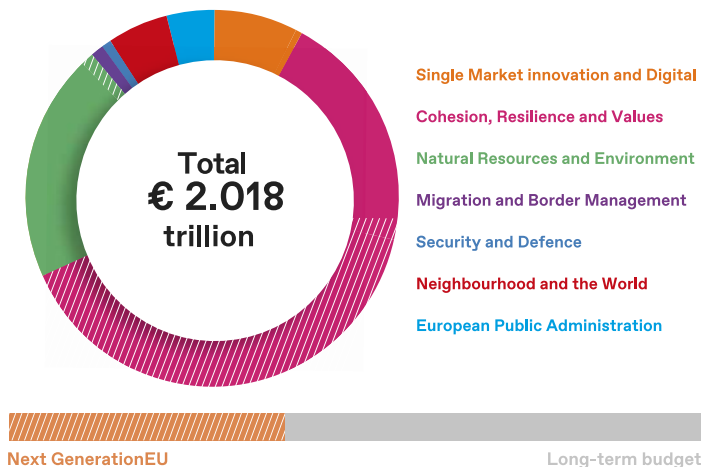
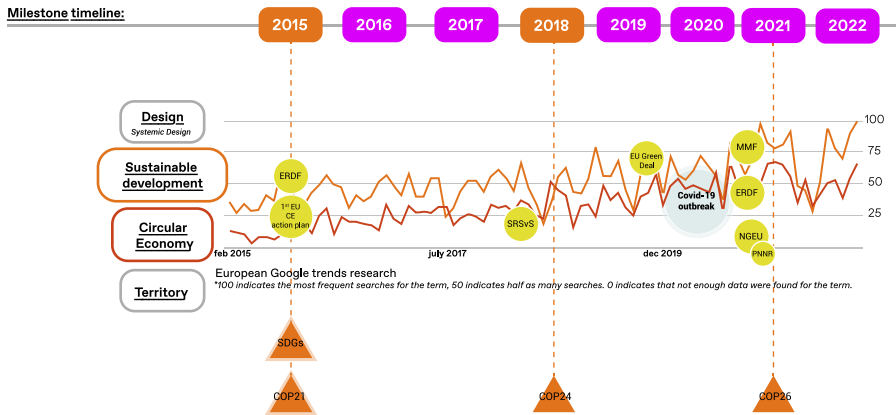


Fig. 2
European funds allocated for the financial framework 2021-2027.
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The research context has been set by defining a time frame based on facts, publications and projects that intertwine sustainable development trends and the Circular Economy. As shown in the scheme depicted in Fig. 3, several keywords used within the search queries were considered, revised according to trend analysis, and associated with the outlined national, European and international action plans and strategies.



Two thousand fifteen marks a year to start talking about concrete actions to be taken and goals to be achieved. On September 25, 2015, the 193 states of the UN General Assembly adopted the 2030 Agenda entitled *Transforming our World*, setting ambitious goals that promote cross-sectoral and multidisciplinary cooperation to change the world together.

Fig. 3
 Timeframe about Sustainable Development and Circular Economy Trends.
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Methodological Approach to Enable an Innovative Research Process

The methodology adopted at this research stage combines various elements to determine a clear picture of the context in which the research is carried out and then to outline the gaps to intervene through pilot studies in the following years of the doctoral journey. The starting and primary point of the methodology adopted is to answer the following research question: *How can Design, particularly Systemic Design, support sustainable territorial development strategies (at the local and regional level) in a (post) pandemic context?* For this purpose, the research considers facts and papers from 2015 (Fig. 3), the year in which the Sustainable Development Goals were defined within the COP21 objectives. The first Circular Economy Action Plan was published and then arrived at the current (post) pandemic transition context. A methodology implements the research based on four steps, which were analysed according to the double diamond innovation process (Design Council, 2005), integrated with the gradual dynamics of divergence and convergence theorised by Bela H. Banathy in 1996 (Fig. 4).

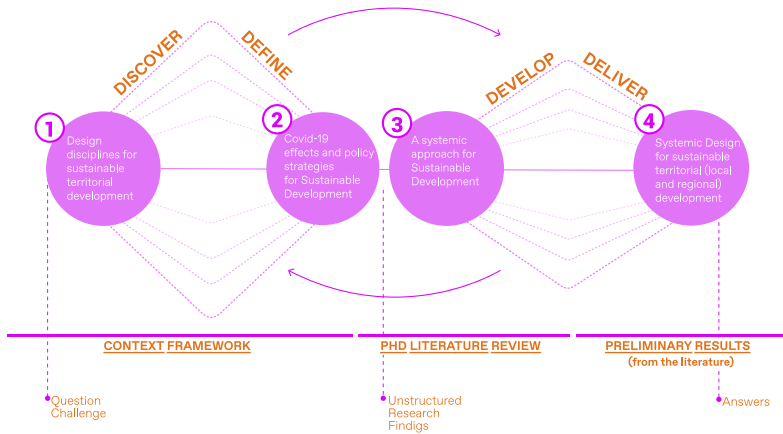


Fig. 4
Visualisation of
Methodological process.
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The methodological choice of combining the two processes mentioned above is because, on the one hand, the double-diamond process prepares an innovative way to approach the topic, including through the literature review process. On the other hand, Banathy's theorisation emphasises the *iterative nature of the design process* (1996). Systemic Design is crucial to assessing the process and projects' effects in the analysed context.

The steps for defining the context within which the research is articulated are explained here. Then we move through the literature review process to convey the preliminary results:

Step 1. is characterised by the review of the academic literature with the addition of reports and research by the world's leading exponents who are concerned with analysing the role of design in decision-making contexts involving not only private spheres but also the public sector (e.g., Design Economy by *Symbola*, OECD Reports);

Step 2. instead investigates the strategic directions of intervention proposed by the different post-pandemic action plans for long-term planning. This provides insight into the complexity behind the action programmes and how the discipline of design can be called upon;

Step 3. brings together the first two steps towards a more specific in-depth study of the research that orbits around Systemic Design for sustainable development and the disciplines close to this field of the design discipline to define some interpretative keys starting from the analysed panorama.

Finally, Step 4. converges all the previous steps of the research to give the preliminary results of the analysed context so that it is possible to outline the intervention scenarios of the doctoral study.

Preliminary Results From the Literature and Analysis

The systematic literature review was carried out through two primary databases (Scopus and Web of Science) to define the impact of Design disciplines on the sustainable territorial transition. *Table 1* highlights the results obtained through a query that was purposely

wide-ranging to include all the topics and fields that have dealt, to a different extent, with design for sustainable development and transition of territorial socio-technical systems. Ultimately, the records obtained from the other databases have been cross-referenced to eliminate duplicates. Among these, the references that did not conform to the search by geographical area or topic were eliminated.

Query	Database	Records	Final publications
TITLE-ABS-KEY ((systemic AND design OR transition AND design OR design AND for AND sustainability) OR (participatory AND design OR co-design) AND ((regional OR local AND sustainable AND development) OR (regional OR local AND sustainable AND transition))) AND (LIMIT-TO (PUBYEAR, 2022) OR LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015))	Scopus Web of Science	422 217	50

The step-in progress of this preliminary research is the analysis of the collected results and their categorisation according to the main topics dealt with. It is already possible to present an outline of the most relevant keywords highlighted by the databases (Fig. 5) that will allow a general analysis of all the contributions. Greater attention was placed on identifying the areas of design that emerge from the documents within the databases. Those design areas reflect the keywords entered in the search query. However, also other design disciplines have emerged in support of bringing out the opportunity for contamination between methodologies and the design application.

Tab. I
The significant impacts of Design disciplines for sustainable territorial development. © Authors.



Fig. 5
Literature Review keywords. © Authors.

The figure (Fig. 5) shows the keywords identified by the authors in a hierarchical order: some topics of the research are more general (Rural Development, Local Government, Land and Resource Management, Policy Making), and others are related to specific interests (Urban and Regional Planning, Tourism, Cultural Heritage, Local Community). After analysing the keywords, an in-depth reading of the most relevant publications was done based on relevance and the number of citations. For example, we excluded the publications that are out of topic regarding projects developed and the research output. *Table II.* shows a paper selection related to the main issues highlighted and listed in this preliminary literature review phase.

Topic	The main aspect highlighted	Main publications
Policy and Governance	Co-creation; Collaboration and Stakeholders' engagement;	Righettini, 2020; Heitmann, F., Halbe, J., & Pahl-Wostl, C., 2019
Visioning and Planning	Strategic Vision; Resilient Communities	Fredericks et. al 2022; Fouché, E., & Brent, A., 2020
Educational and Cultural aspects	Cultural shift; Transdisciplinary Approach	Arbogast et al. 2020, Trott, C. D., Weinberg, A. E., & McMeeking, L. B. S. (2018).

Tab. II
The main topics and aspects highlighted in the literature for sustainable territorial development.
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The Design Contribution for a Disruptive Sustainable Territorial Transition

The analysis of the keywords from the literature allows us to identify some of the main areas of Design that emerged from the cross-section between design and sustainable development of the territory according to the applications and perspectives of the Circular Economy like *Design for Sustainability, Transition Design, Policy Design, Service Ecosystems Design*. Fig. 6 shows the intersection, done on different scales, between the specific topics emerging from the literature belonging to other Design disciplines and those most closely addressing the proposed research topic. This highlights that design can contribute to radical transformations requiring long-term, systemic, and structural societal changes (Loorbach, 2010). In this scenario, Systemic Design can propose methodological and practical tools to develop strategies for sustainable development policies, collaborating in environments strongly characterised by transdisciplinary environments.

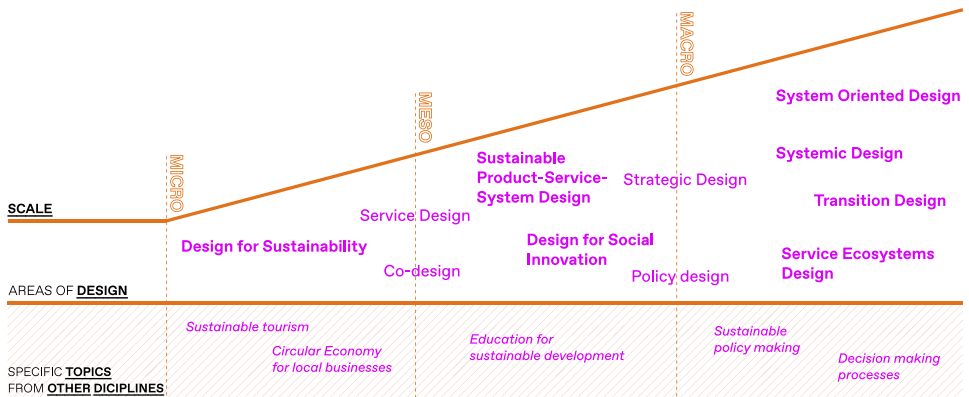


Fig. 6
Literature Review categorised keywords.
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Discussion and Conclusion

This first literature review shows that Design disciplines, specifically the ones closer to Systemic Design, are mentioned in multidisciplinary scientific publications addressing the sustainable transition of territorial systems. Very often, systems thinking is mentioned in contrast to or in support of the creative process of design thinking, highlighting how the different components that make up this design

area are exceptionally flexible and highly cited, especially within the chosen time frame. The terminology is indeed loose, and it is possible to apply it beyond the areas of design. Equally important is that on the international scene, the methodological frameworks of strategy are considered in decision-making processes and co-design spaces with policymakers (Mortati *et al.*, 2016). The paper lays the groundwork to address the research gaps previously mentioned, with its contribution based on the desk research conducted and within projects developed that will be worked in a co-disciplinary and cross-sectoral arena with the Sys – Systemic Design Lab (<https://www.systemicdesignlab.it/>) from Politecnico di Torino. One of the first significant gaps to be addressed in the short-medium term is the definition of practical tools and methods to actively engage stakeholders. This is to enable decision-makers to understand how they can be incisive in the activities they outline if supported by external actors such as designers, who are able to connect people with their know-hows an expertise, resources on a specific context and thoughts that come from the designing process, with a systemic perspective. After defining these tools, it is essential to develop a framework carefully and universally, as the Design Value Framework of the Design Council, to measure the impacts that Systemic Design has on society through the projects and research conducted. Really understanding the dynamics generated when designers are called upon to activate participatory design processes, with an impact on places and people for their sustainability, is crucial, to understanding their real value. The next steps of this work are to address the gaps highlighted by the literature review and to study multiple design methods to support transition processes in transdisciplinary contexts. This is because implementing design-led procedures fosters co-creation and strengthens socio-economic systems; in a long-term perspective, crucial for policymaking, especially concerning the recovery of Covid-19 implications. Transitions have been framed as design challenges with technological, creative, and political dimensions.

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Dasein Ist Design: An Ontological Discussion of Design in the Ecological Crisis Time

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Abstract

The paper introduces preventive innovation as a possible way for design to address global challenges within the broader context of the Bio Revolution, understood as a dual convergence – technological and cultural – between biology and artifice. The interrelated condition, amplified by environmental crises and technologies that go so far as to recreate nature, requires a broader reflection on innovation and a proactive and preventive attitude that allows us to develop a new awareness of the reality surrounding us. To focus on the ontological dimension of design in this context, we will describe part of the results of “Biovision of the Future”, a research and critical reflection path promoted by the authors with the contribution of Stefano Marzano. The results under discussion are five “attitudes” deriving from the critical reconsideration of some paths that design takes in the Bio Revolution. These may be valuable references for design approaches aimed at preventive and post-anthropocentric innovation.

Keywords

Preventive innovation
Bio revolution
Post-anthropocentrism
Multidisciplinary roundtable
Ethics

Introduction: Bio Revolution and Preventive Innovation.

If the whole fabric of our earthly existence has to be redesigned in excruciating details; if for each detail the question of good and bad has to be raised; if every aspect has become a disputed “matter of concern” and can no longer be stabilised as an indisputable “matter of fact”; then we are obviously entering into a completely new political territory. (Latour, 2009, p.8)

In this way, Bruno Latour introduces Political Ecology as a new field of action, encouraging designers to expand their role in “drawing together” not only the details of daily objects, but also cities, landscapes, nations, cultures, bodies, genes and nature itself, allowing modernism to break the deadlock of progress.

As Oosterling (2009) summarizes in the philosophical catchphrase “Dasein ist Design”¹, we live in an age in which the world is increasingly permeated by design, both understood as the design process and as the effect of such process. Every aspect of our existence (from the technologies we use to consumption patterns and social or political structures) results from human design. At the same time, we are also shaped and influenced by design, as the systems and structures we live in influence how we think and act.”Dasein ist Design” therefore implies that humans are responsible for their design choices and that these choices significantly impact how we live and interact with the world. It invites us to reflect on our ethical responsibility as designers of our Being and our environment and the need to consider the long-term effects of our actions.

In today’s context, in which sophisticated technologies make everything “technically possible” and in which our actions are also capable of affecting the balances that keep the Planet alive, it is necessary to introduce into the creative process a new type of “preventive” reasoning that stimulates greater ethical awareness in all those involved in innovation, taking into account negative scenarios as well as the positive ones of any scientific development. The ultimate aim is to develop a culture of prevention shared by the various human spheres of research, ethics, spirituality, politics and justice. It is, first and foremost, a cultural operation that implies taking responsibility for future scenarios and a commitment to build remedial tools beyond those of progress to prevent the undesirable.

In this context, designers can act as catalysts within a more complex network of actors and interlocutors thanks to their abilities to read and interpret reality, integrate multidisciplinary knowledge, and represent concepts through metaphors and images. The latter can facilitate the exchange and collective creativity of multifunctional groups in decision-making processes or offer projections of future scenarios and possible solutions. In this regard, Paola Antonelli (2019) asserts that design, while not being able to solve our existential problems, is nowadays configured as a well-considered “repair strategy”, capable of supporting through the production of artefacts of various kinds a reconciliation between human beings and the complex systems that surround them, towards a more equitable and guaranteed future for all. Designers should field an acute critical sense to analyse the multiple links that connect humans to their environments (economic, social, cultural, ecological and political) and design reparations in the form of artefacts and concepts that can

1

The sentence translates as “being (there) is to design”, where the Heideggerian proposition of ‘Dasein’ (to be there, to be-in-the-world) represents the existence of humans in connection with the world, the others and themselves. The catchphrase is in the original language (German).

help the community to emerge from a common sense of “blinding hypocognition”².

In particular, unlike in the past, we now witness the gradual fading of the boundary between things that represent the artificial and those that represent the biological, between culture and nature, bringing with it a series of ethical-philosophical but also practical-designing questions worth discussing. The term “Bio Revolution” refers to a set of advances in the biological sciences and biotechnology, as well as exponential advances in computation, data analysis and automation, which are fuelling a new wave of innovation that could have a significant impact in different sectors, from food and consumer goods production to health, changing business models, value chains and design practice (McKinsey Global Institute, 2020). More broadly, the Bio Revolution refers to a new set of technological possibilities and issues that exceed our ability to remain within the domain of the artificial and make it almost impossible for us to break them down into existing disciplines. A convergence that is not limited to technologies alone but extends to political, economic and social systems, which become increasingly complex and prefigure a “neo-biological” civilisation in which the “realm of the born” (all that is nature) undergoes various forms of engineering and the “realm of the made” (all that is humanly constructed) evolves towards a “bio-logic”, without which it cannot continue to work (Kelly, 1994).

At the same time, the emergence of environmental and planetary issues is undermining the anthropocentric concept of sustainability based on the search for forms of habitability on the Planet that see humans dominating other creatures, giving way to a geopolitical vision of nature in which social and ecological instances are strongly interconnected (Latour, 2000). In other words, the dissolution of the boundary that used to delineate the artificial sphere, as well as the encroachment of human and design activity to the natural sphere, are nowadays also and above all visible in the complex challenges facing the ‘Earth system’, leading to the emergence of new cultural metaphors and philosophies that see humans as an active and interconnected part of a great entanglement of hybrid relations with the technosphere, the biosphere and the geophysical environment. Some theories, such as the “Hyperobjects” theory (Morton, 2018), the “Object Oriented Ontology” (Harman, 2018), and Critical Post-humanism (Haraway, 1985/2018; Braidotti, 2020), definitively challenge the late-capitalist ideology of pure survival and sustainability, extending philosophical thinking outside humans, to the point of questioning reality and its perception in order to outline evolutionary systems capable of including and mixing different forms of life. In the post-anthropocentric perspective, humans are decentralised to a “mobile assemblage in a shared living space that they neither control nor possess, but simply occupy, always traversing in community, in a group, in-network” (Braidotti, 2020, p.1); while environmental sustainability becomes a broader concept, which does not only include the reduction of human impact on the Planet by conserving resources, but the ability to establish new forms of cooperation with nature and with mutualistic benefits for both parties.

One might wonder what the “good of design” is in this context and how designers can perceive, understand and take responsibility within complex systems they cannot control. How could the

“good of design” stimulate ethical, systemic and long-term responsibility in all innovation stakeholders? At a time when everything is “technologically possible”, but the design certainties are disappearing, what are the new values that design can refer to? How can design make governments, power structures and the whole community more aware of the near future, if possible interspecies?

Biovision of the Future

Starting from these assumptions, “Biovision of the Future” was born, a path of research and critical reflection on the issues concerning the Bio Revolution and the related design challenge in defining more sustainable and desirable life models. The research path, promoted by the authors with the contribution of Stefano Marzano (CEO of Philips Design from 1991 to 2011), involved numerous experts, professors, researchers and more than 30 PhD students from different disciplines with the macro-objective of stimulating a more critical and strategic design culture regarding the use of the most advanced (bio)technologies. The attempt was also to answer the numerous questions that arise at a time when a material, multidimensional, and multiverse convergence between nature and artifice stimulates addressing systemic change, contemporary challenges and the very value of sustainability from a cultural rather than technological perspective. With a view to preventive and ethical innovation, the design must handle the enthusiasm of solving contemporary challenges by simply rethinking products and processes from a biological perspective. So, it is of great importance to go beyond the individual point of view of the designer collaborating with the scientist to implement biotechnology or to explore its social dimensions towards listening to and synthesising multiple opinions that also contemplate new approaches to ecological understanding as well as systemic change perspectives towards preferable futures.

In particular, “Biovision of the Future” was structured in four phases, each including specific participatory and multidisciplinary discussion activities.

The first phase consisted of a virtual round table entitled “Biovision of the Future. Discuss life through design” on the ethical-scientific-cultural implications of the Bio Revolution. The technological possibilities opened to design in the whole range of human interactions – the well-intentioned and the criminal – were discussed, and the different disciplines were confronted by three great powers, according to Stefano Marzano, fundamental in defining the boundaries of human activity: economic (which through investment decides what we seek); political (which regulates development and directs the legal side); spiritual (which has a significant influence on ethical and moral spirituality) (Massoni, 2022).

The second phase consisted of a two-part lecture by Stefano Marzano and Reon Brand (Senior Director Foresight and Socio-cultural Trends, Philips Design) on the co-emerging trajectories that define current and future change (Brand, 2019). In particular, the focus was on the trajectory of “Gaia”, i.e. post-anthropocentric future directions and how design can catalyse them.

The focus of the third phase was on the technological trends of the Bio Revolution, involving Sapienza professors and researchers in cutting-edge disciplines to explain their research focused on the main contemporary issues: environmental sustainability, social well-being and personal health.

Instead, the protagonists of the fourth and final phase were PhD students from several disciplines and six Sapienza departments involved in a workshop entitled “Biovision of the Future. Design challenge for a sustainable and desirable life” lasting five days. During the workshop, which took place at Saperi&Co (Research and Service Centre of the Sapienza University of Rome), the tools, notions and streams of thought deriving from the previous phases were applied to co-design six scenarios and product concepts focused on rethinking the way we live our homes, cities, bodies and the global challenges of the Planet from a post-anthropocentric perspective.

“Revolutionary” Attitudes in Bio Revolution

In order to focus on the ontological and even axiological dimensions of design, we will describe the results of the first phase of the Biovision project. The roundtable, which involved seven multidisciplinary experts³, focused, in fact, on a critical reconsideration of some of the paths that design is taking in the context of Bio Revolution characterised by systemic transformations, global crises and hybrid interactions. The aim was to define some attitudes and methodological supports to which design can refer for preventive and post-anthropocentric innovation.

The roundtable followed a well-defined methodology, starting with the sharing of some visual and introductory contributions (videos, images, design projects), which showed to participants the state of the art on Bio Design, thus the set of transdisciplinary design practices *of, with and from* biology stimulated by the “germinating” scientific-technological context (Myers, 2012). The aim was to stimulate involvement and synaesthesia of thought and to align participants on the same specific issues through the visual exemplification of possible scenarios or the description of tangible examples. Successively, a ‘critical thinking’ phase was carried out, in which we asked participants two questions: the first on a specific aspect of their research identified by the authors as relevant to the discussion, the second on their point of view (and that of their discipline) on the issues treated. In this way, the speakers equally participated in the discussion and get to know their interlocutors and their thinking to prepare for the next and final “critical roundtable” phase. The latter, structured as a brainstorming session and mediated by Stefano Marzano, aimed to define some attitudes or behaviours that design practice should assume to cautiously and attentively face the new revolutionary wave. In particular, during the brainstorming activity, each participant was asked to express one or more attitudes, i.e. a valuable indication for raising ethical awareness among designers and collectivity, stimulating more responsible and mutualistic behaviours for humans and all that surrounds them. All participants extensively discussed each attitude, in its negative and positive aspects, effectiveness and efficiency (both in the short and long term). In the

3

The experts involved were: Stefano Marzano (designer-architect), Roberto Poli (futurist-sociologist), Mauro Magatti (sociologist-economist), Leonardo Caffo (philosopher), Carmelo De Maria (bioengineer), Mons. Carlo Maria Polvani (churchman), Francesco Morace (sociologist).

end, five attitudes were selected: anticipation, prevention, caring, sharing, and signification.

The first attitude, *anticipation*, derives from future studies and is the third level of investigation after “forecasting” and “fore-sight”, understood respectively as the statistical extrapolation of plausible futures and the visualisation of possible futures through scenario construction. Anticipation incorporates the two previous models and translates them into strategic decisions and actions that act now for preferable futures. In a context such as the current one, where changes are constantly accelerating, acting “anticipatively” means proactively preparing for the future by modifying the behaviour (Poli, 2019). From a post-anthropocentric perspective, anticipation allows us to reflect on our acting modalities and the possibility of aligning them with nature’s evolutionary strategies. When we realise that we are an integral part of the “world system” and not a separate species, we abandon the rules of progress in favour of evolution. Whereas progress sees the future as a certain endpoint, with man at the centre and a linear path to perfection, evolution is characterised by an uncertain, contextual and unintended future. Each species evolves by adaptation, adopting strategic solutions that guarantee survival in a given context. Similarly, with a rhizomatic, experiential and collaborative approach, anticipation proceeds by differentiation, not imposing a specific direction but leading to radical and emergent changes from multiple perspectives. In this regard, design becomes a “future-oriented act” (Caffo & Muzzonigro, 2018), a creative action for concretely translating anticipation in products, services and systems that foster the delicate process of “adjustment” of individual and collective behaviours and awareness.

Directly related to anticipation, the second attitude of *prevention* aims to emphasise the importance of moving away from a reactive, wasteful and inefficient approach to favour the mitigation of impacts, the management of critical issues and the exploitation of possible opportunities. For these reasons, we should include critical awareness and strategic thinking in design practice. In the first case, this means the ability to analyse situations critically concerning the value we want to give to a project or an action, also investigating the dark side. In the second case, a continuous flow of critical investigation of action starts with assessing the risks involved and understanding the value we want to create to develop a strategy. Prevention is essential, for example, in biology manipulation and engineering: while this may be an advantage from a sustainability point of view, it must be taken into account that biological systems are self-sufficient, self-replicating and interconnected, leading to potentially cascading and long-lasting effects on entire ecosystems and species. The relatively cheap and easy access to biotechnology also makes the potential for misuse considerable, reinforced by other factors such as inadequate biological data protection laws, different jurisdictional value systems and the desirability of biotech markets (McKinsey Global Institute, 2020).

The third attitude identified is *care*, a central principle for sustainable design that goes beyond reducing environmental and social damage caused by our activities towards a more radical and existential attitude stimulated by the awareness of being part of an interconnected system (Ehrenfeld, 2009). Starting precisely from the

Heideggerian concept of 'dasein', Ehrenfeld (2009) asserts that the moment we understand Being as the existence and not as an entity, caring becomes a manifestation of empathy, attention and responsibility towards others and the environment because it makes us aware of the consequences of our actions. As Magatti (2020) also affirms, care is not concerning the intimate or private sphere but is a way of being-in-the-world and perhaps the most crucial attitude to which the entropic model of modernity has disabused us. As underlined by the dual etymology of the word, the Latin *cor urat* (meaning "warms the heart") and the classical *cao* (meaning "to see"), the theme of care has a cognitive scope since it recovers dimensions that we tend to put in brackets, and pushes us to learn – with affection and engagement – the principles and relationships that characterise the environment in which we live. Caring allows us to develop meaningful connections with others and build strong communities. Through caring, we engage in mutual support, respect and promote collective well-being, thereby creating deep and meaningful human connections.

The fourth attitude, *sharing*, is a multifaceted concept understood here as the need to address the complexity and contemporary challenges in a shared, multistakeholder and multidisciplinary manner. It refers to the awareness of inhabiting a shared world that, as a complex dynamic system, owes its characteristics to the causal, reciprocal and interdependent relationships between the parts rather than to the sum of them. In this perspective, new technologies can be a tool that allows us to assume collective and collaborative behaviours between humans, but also human-artifice and human-nature. In fact, sophisticated contemporary technologies can break reality into its basic units - atoms, bits, genes, quanta or perceptrons - and translate data sets from one dimension to another, enabling interaction, development and mutual enhancement.

Finally, the fifth attitude identified is signification, a fundamental element in human communication and in attributing meaning to the world around us. Design can communicate new meanings through objects, products, systems or experiences, from how we use and interact (Norman, 2014) to political messages and cultural meanings (Fry, 2010). Design can help create new meanings for sustainable innovation by communicating new values, stimulating sustainable behaviour, and raising awareness of environmental and social issues through experiences and emotional or participatory user involvement (Manzini, 2015). Today, with technological developments able to 're-write' information at the base of things (computation, nanotechnology, biotechnology, etc.), design reaches the essence of objects and extends signification to the things' materiality: air, water, genes, atoms, bits, and neurons become design parameters, while material or immaterial artefacts become almost entirely designable, from the essence of matter to the qualities of their behaviour.

This intensity of action, which also encompasses the extension of design to more and more aspects of our lives, indicates how design evolves towards a living paradigm in the objectives, approaches and productive models. Thus, the design becomes increasingly aware of the interdependencies rising around an artefact and recalibrates its modes of action and design expression on them.

Conclusion

Innovation, especially technological innovation, can make our lives easier, but it is equally clear that it can entail risks we must learn to manage. The interrelated condition, amplified by environmental crises and technologies that go so far as to recreate nature, requires a broader reflection on innovation and a proactive and preventive attitude that allows us to develop a new awareness of the reality surrounding us.

Thus, in order to produce innovative and sustainable solutions (also involving biology), designers shall analyse the entire complex and contradictory nature of contemporary design objects: they shall make explicit the benefits but also track the unwanted consequences; they shall take a strategic perspective, focusing on long-term vision and risk mitigation; they will need to employ an experimental approach to change, able to self-correct as conditions change without losing the project's intention.

The goal is to offer visions and scenarios useful for a more mature dialogue on future decisions, in the hope that the discipline's contribution acts as an invitation and stimulus to be – to return to Latour (2009) – “radically careful, or carefully radical”.

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The More-Than-Human Trend in Design Research: A Literature Review

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Abstract

The implications of contemporary technological and environmental changes are driving a transition in human practices toward approaches that widen and shift the focus beyond human needs. These approaches leverage new ideas and concepts coming from the posthumanist perspective, which has been gaining momentum across several disciplines, including the design field. As several researchers have started to take interest in those themes, experimental methods and practices have been growing along with different definitions, which may accentuate the complexity of producing consistent advances in the discipline. The objective of the article is to review the existing literature on design practices and approaches that, during the last decade, have evolved beyond the focus of a single user and are thus defined with terms such as More-Than-Human Centered Design, Ecosystemic Design, Posthuman Design, etc. The outputs of the integrative literature review offer a clearer picture of the phenomenon.

Keywords

**More-than-human
centered design
Posthumanism
Ecosystemic design
Community-centered design
Multispecies design**

Introduction

Human Centered Design (HCD) scope has grown in the past decades, until becoming the most established and popular approach for both practitioners and researchers in the design field. However, the implications of recent technological and environmental changes are driving a transition in all human practices toward approaches that widen and shift the focus beyond human needs. These approaches leverage new ideas and concepts coming from the posthumanist perspective, which has been gaining momentum across several disciplines (Forlano, 2017) design has been dominated by a human-centered and user-centered paradigm. Currently, the implications of technological and environmental transformations are challenging designers to focus on complex socio-technical systems. This article traces emergent discussions around posthumanism from across a range of disciplines and perspectives, and considers examples from emerging design practices that emphasize the interrelations between human and nonhuman actors. Specifically, this article reviews literature from actor-network theory (ANT, with the contribution of the growing political and social attention regarding the environmental impact of production and development of humankind on Earth. Such reflections are based on the awareness that the challenges which we face as a species require a systemic approach and a redefinition of the very boundaries that define what it means to be human. Driven by the acknowledgement that all living and non-living beings – far beyond the influence, benefit and direct impact of humans – may be active agents within the global production systems, Davidová and Zavoleas advocate the need to define a nature-driven model for design practices, inherently flexible and in a constant state of openness and readiness for change, which is mandatory to lay the groundwork toward a better future for the planet and the biosphere (Davidová & Zavoleas, 2020). In short, approaches that extend the focus from an individual human actor to several other types of actors. The challenge to rethink HCD requires users to take a step back – or rather to the side – and leave room for considerations on several matters, such as:

- who or what are the actors (more than just individual human users);
- who or what are we designing for;
- who or what has agency in the design process;
- what design should be desirable and for whom.

More-than-human practices include several themes and perspectives (Levy, 2015). Primarily, the focus has been set on the ecological impact of design and the needs of non-human species, by – for example – taking animal personas into consideration (Frawley & Dyson, 2014). The socio-technical perspective focuses, instead, on the influence of robotics, wearables, ubiquitous computing and other disruptive innovations on social systems, ultimately challenging the Western idea of human (Giaccardi & Redström, 2020). Also, authors are widening the focus from the needs of a single user to those of complex social groups and networks (Tomlinson et al., 2021), with a special attention to issues related to city making initiatives, participatory practices and policies towards cohabitation in smart cities (Clarke et al., 2018). It is worth mentioning that even Donald Norman,

the main theorist of User Centered Design (UCD) in the 1980s, is currently moving his perspective towards a broader vision on systems, communities, and non-human actors (Dam, 2021).

As several researchers have started to take interest in those themes, experimental methods and practices have been growing (Tomitsch et al., 2021) leading to the rise in prominence of human-centred design. The field of smart cities has equally adopted notions of citizen participation as a way to ensure that technological solutions improve people's livelihoods. However, these kinds of processes treat the urban environment as separate from nature, promoting human comfort and convenience over planetary health and wellbeing. Motivated by these growing concerns that highlight the urgency to reconsider how we define and practice participation in smart cities and in human-centred ICT solutions more broadly, this article assesses how the personas method can be adapted to include more-than-human perspectives in the design process. Based on a case study, which involved designing smart urban furniture for human and non-human use, we introduce a framework for developing and employing non-human personas. As a key element of the framework, we describe a middle-out approach for forming a coalition that can speak on behalf of the non-human species that are impacted by design decisions. We demonstrate how the framework can be used through its retrospective application on two research-led smart city projects. The article concludes with a discussion of key principles for creating and using non-human personas in design projects." "container-title": "Interaction Design and Architecture(s, along with a dozen different definitions, which may accentuate the complexity of producing consistent advances in the discipline. The main objective of this paper is to review the existing literature on design practices and approaches that, during the last decade, have evolved beyond the focus on a single user and are thus defined with terms such as More-Than-Human Centered Design, Ecosystemic Design, Posthuman Design, Community-Centered Design and Multispecies Design, to provide a clear overview of the phenomenon.

Objective and Methodology

The fragmentation of the terminology referring to the More-Than-Human trend makes it difficult to explore and have a complete picture of the phenomenon. In such a context, conducting an integrative literature review is an effective method to summarize past literature and provide a more comprehensive understanding of the field (Snyder, 2019). We based our literature review on four criteria:

CRITERION 01. First of all, a specific time range in which to conduct the search for items was defined considering that literature regarding Posthumanism has mainly emerged among various fields since the end of the 20th century. We thus decided to consider a timespan of the last 12 years, starting from 2010. It must be noted that the search was conducted in April; this detail causes a drop in the items collected in 2022 compared to previous years.

CRITERION 02. Secondly, the search queries were defined consider-

ing previous exploration of the literature, in order to choose beforehand the main terminologies adopted in the phenomenon. Such terminologies may refer to broader approaches or being very specific on a particular area of the design field; considerations on that will be discussed in section 3.

CRITERION 03. Finally, the search has taken place by using three search engines: *Scopus*, *Academia.edu*, *Google Scholar*. Google Scholar is a freely accessible web search engine released in 2004 by Google and that indexes full texts or metadata of scholarly literature across an array of publishing formats and disciplines. While most academic databases and search engines allow to select one factor to rank results, Google Scholar uses a combined ranking algorithm that weighs the full text, the author, the product in which the item appears and how often it has been cited by others; research has shown that the last parameter appears to be the most relevant (Rovira et al., 2018) by relevance, in Google Scholar and the subsequent evaluation of the importance of received citations in this ordering process. The methodology of reverse engineering was applied, in which a comparison was made between the Google Scholar ranking and another ranking consisting of only the number of citations received by documents. This investigation was conducted employing four types of searches without the use of keywords: by publication, year, author, and “cited by”. The results were matched in the four samples with correlation coefficients between the two highest rankings, which exceeded 0.9. The present study demonstrates more clearly than in previous research how citations are the most relevant off-page feature in the ranking of search results on Google Scholar. The other features have minimal influence. This information provides a solid basis for the academic search engine optimization (ASEO). *Academia.edu* is a for-profit social network and repository of academic articles free to read by visitors, while uploading and downloading is restricted to users. The site was launched in 2006 and has grown to the point that the number of registered users reached 180 million in early 2022 (*Academia.edu | About*, 2022). Due to the introduction of premium paid features, *Academia.edu* only allows searching for queries within titles, rather than in full texts. *Scopus* is a scientific database launched in 2004, which covers three types of sources, mostly peer-reviewed: book series, journals, and trade journals. It allows users to select the preferred factors to rank results, by searching for the selected query in titles, authors’ names, abstracts, keywords and more (Burnham, 2006). *Scopus’* depth of coverage only goes back to 1966, but that does not represent an issue for the particular objective of our research. In general, *Scopus* is one of the most authoritative sources, but not necessarily the most comprehensive.

CRITERION 04. We ran the queries in the abovementioned engines and collected the top 20 results for each of them. Google Scholar’s output depends on its ranking algorithm, while the free plan of *Academia.edu* only allowed us to search for our queries within titles; finally, we selected “relevance” as a sorting factor in *Scopus*. The search output consists of 317 unique items, which we organized by year of publication, DOI and citation in an open dataset on Zenodo (Vacanti et al., 2022). Not all queries reached our limit of 60 results,

as each search engine yielded sometimes less than 20 results, supporting thus our hypothesis that design research has only recently focused on posthumanism Tab. I.

	Scopus	Academia.edu	Google Scholar
More-than-human AND Centered AND Design	16	8	14
Ecosystem OR Ecosystemic AND Design	20	4	17
Posthuman AND Design	20	8	17
Humanity AND Centered AND Design	20	20	20
Post-anthropocentric AND Design	8	17	17
Community AND Centered AND Design	20	17	16
Multispecies AND Design	15	4	19

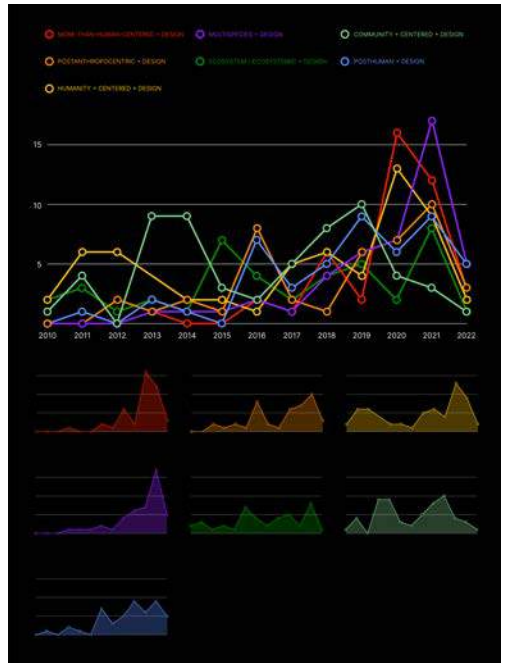
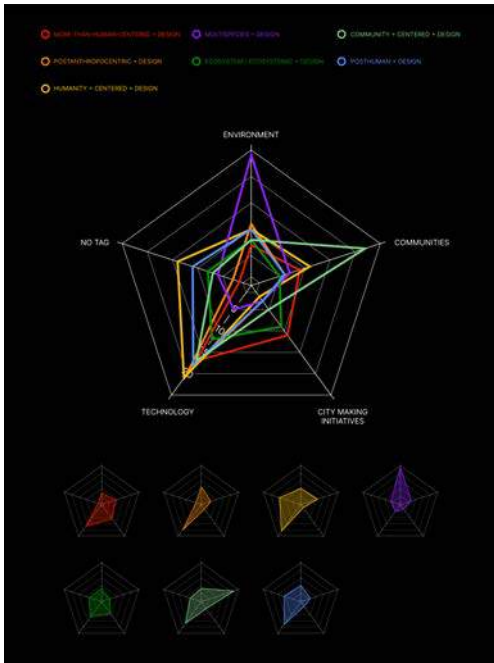
Tab. I
Number of results from the search run in April 2022 on 7 selected queries.

Results and Critical Analysis

After collecting the data, we analyzed the occurrence of specific terminologies within the items and deepened our research by proposing a categorization that highlights the theme of each article. This activity allows us to map the slight variations of perspective among different terminologies. Four categories have been retrospectively defined as follows:

- *Environment*: the focus is on the impact of design on the planet and non-human species, thus recognizing the importance of a systemic approach that takes into consideration a broader set of matters, rather than just focusing on human needs and satisfaction.
- *Technology*: the focus is on the influence of technological innovation on design and collaborative systems that involve humans and artificial agents, acting as equals.
- *Communities*: the focus widens from the needs of the single user to those of a whole community, taking into consideration the complexity of human relations within our contemporary societies.
- *City making*: the focus is on practices and policies that aim to improve living standards and cohabitation in urban areas, by leveraging citizens' participation.
- *Not defined*: the item refers to design theory and practice, but it is not possible to categorize it through the previous definitions.

The following section will discuss the results of our search, through a conceptual Fig. 1 and chronological analysis of each query.



More-than-human AND Centered AND Design (38 items – 16 Scopus, 8 Academia.edu, 14 Google Scholar). As shown in the timeline, MTHCD seems to be the fastest-growing terminology in the field, with a very high peak registered since 2020. Although showing a slight majority of items revolving around the theme of technology, MTHCD appears to have a quite broad focus, shifting from socio-technical matters to city making initiatives and needs of communities. Most of the items discuss technological innovations – Artificial Intelligence in particular – through their potential to facilitate the interaction among humans and non-human agents (Coulton & Lindley, 2019; French et al., 2020). Also, technology is considered to have agency in the design process, by generating data and information (Giaccardi & Redström, 2020).

Fig. 1
Annapaola Vacanti, 2022.
Radar diagrams showing which topics are covered by which terminology within the posthumanist scope in design.

Postanthropocentric AND Design (42 items – 8 Scopus, 17 Academia.edu, 17 Google Scholar). This query seems to be growing slowly but steadily, with a high peak of 10 items being registered in 2021. Among all the queries, it is the one which is most focused on technological matters. However, items in this category tend to keep the human being at the center of the design process, merely exploring how to improve the interaction among users and smart products (Scarpitti & Valsecchi, 2021).

Fig. 2
Annapaola Vacanti, 2022.
Line charts showing how the use of the selected terminologies in scholarly products varied during the last 12 years.

Humanity AND Centered AND Design (60 items – 20 Scopus, 20 Academia.edu, 20 Google Scholar). This terminology shows a unique evolution, being quite common already in 2010 and continuing its growth in the following years, becoming widely used in 2020. It is the only query that reached the maximum of 20 items per search engine. Interestingly enough, this query has its focus on technology,

regardless of the term “humanity” being used in the name. Items discuss various themes connected to the condition of disadvantaged social groups, proposing to use design and technology as drivers to produce positive change and balance differences (Chadalavada & E, 2020; Russell & Buck, 2020).

Multispecies AND Design (38 items – 15 Scopus, 4 Academia.edu, 19 Google Scholar). The timeline clearly shows a dramatic increase in items using this terminology in 2021. This query is probably the one with the most specific area of interest within the scope of the discipline: almost all of the items refer to the environment category, proposing to place new actors at the center of the design process, namely animals and other non-human agents (Westerlaken, 2021).

Ecosystem OR Ecosystemic AND Design (41 items – 20 Scopus, 4 Academia.edu, 17 Google Scholar). The terms “ecosystem” and “ecosystemic” are used in describing quite a broad range of themes, referring to several areas of design practice. Although being in use already at the beginning of 2010s, the terminology has not reached significant peaks in recent years. Items often refer to issues and activities related to the design of urban and non-urban areas, trying to understand how to improve living standards and cohabitation in those places (Blanco et al., 2021).

Community AND Centered AND Design (53 items – 20 Scopus, 17 Academia.edu, 16 Google Scholar). Being one of the queries with the highest total number of items, CCD seems to be less and less used in the last three years, in counter trend with the other terminologies. Predictably, the main category of interest is Communities, followed by Technology. Most of the items revolve around participatory experiences to develop products and services that target issues of specific social groups and local communities (Pahk et al., 2018).

Posthuman AND Design (45 items – 20 Scopus, 8 Academia.edu, 17 Google Scholar). Posthuman is a term that has been widely used in philosophy and ethics and has gained momentum in the design field as well. However, data show that such terminology never obtained a broad diffusion among scholarly items. The main matter of study is the impact of technology on society (Del Campo et al., 2019), but several items are quite hard to categorize, showing a theoretical approach that drifts into ethical themes.

Conclusions and Further Developments

The scope of design practice – and the academic research related to it – has undergone great transformations since scholars began to displace the project focus in favor of a broad set of non-human agencies. Such a process has led to a revolution, which is still ongoing, in the methodological and mental approach of designers, who have historically been committed humanists and advocates for people against a techno-centric vision of innovation (Forlano & Maze, Accepted/In press). This results in theoretical and practical challenges for design research and education which are made more complex by the fragmentation of the terminology used in literature by

different authors. As we consider the habit of continually introducing neologisms and subcategories to be chaotic and harmful to every area of study, we give our contribution to the evolution of the design field by analyzing non-anthropocentric practices, and their potential impact on the future, by producing a review of the existing literature on posthumanist research in design scope. Some evidence emerged from the analysis are presented below as results of the paper.

A clear growth of academic production is observable Fig. 3, which confirms the research hypothesis regarding the development of the MTH scope in the last decade. In particular, the number of items has significantly grown since 2017, proving that the development is recent. However, it is essential to specify again that the analysis has been carried out in April 2022; therefore, it was possible to include only the data of the first quarter of the year. This results in a final decrease of items observable in the chart.

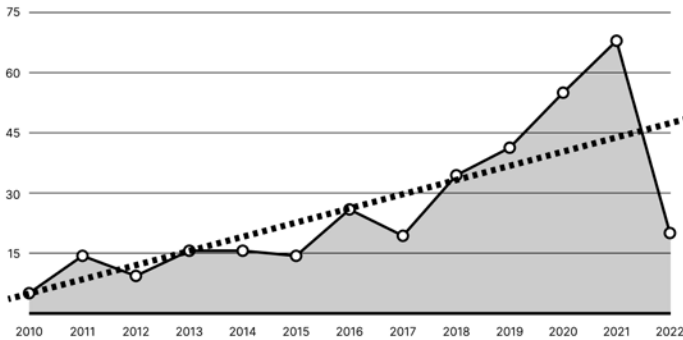


Fig. 3
Annapaola Vacanti, 2022. Line chart showing the overall trend of academic production regarding posthumanist approaches, from 2010 to April 2022.

As stated before, some recurring themes of research have been observed and transformed into tags. Aside from the terminologies, there are some tags more common than others Fig. 4.

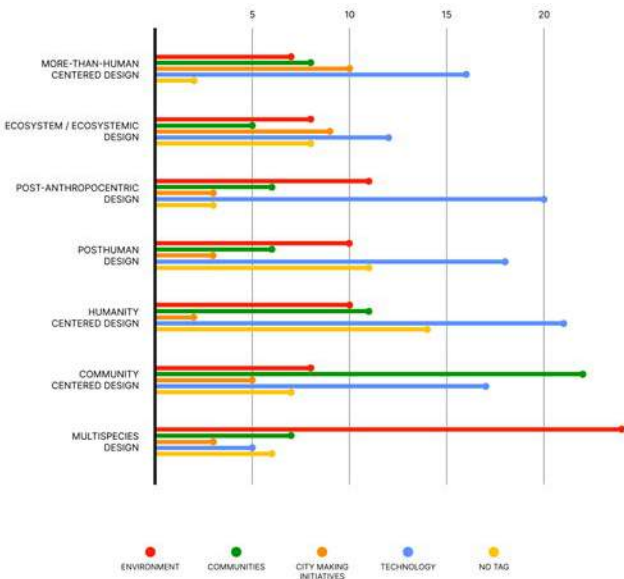


Fig. 4
Annapaola Vacanti, 2022. Grouped bar chart showing the distribution of different thematic categories within each terminology referring to the posthumanist scope in design research production.

Almost one in three items refers to the category of “Technology”. The 23% refers to environmental concerns, while the category “Communities” collects 19% of the total. Lastly, “City making initiatives” collects the 10% while there is a 15% of items that do not refer to any of the tags.

Regarding the use of terminologies, it can be seen a correlation between nomenclature and tags. “City making initiatives” items use mostly “More-than-human Centered Design” and “Ecosystem/Ecosystemic Design” terminologies. Items found in “Multispecies Design” refer mostly to “Environment” and rarely to “Technology”. “Communities” tag refers primarily to items from “Community Centered Design” and “Humanity Centered Design”. These observations emphasize that, even if all the queries can be considered as synonyms, some nomenclatures are more common in specific scope.

Finally, it is important to point out that this paper is an expression of the authors’ Western (South European, Italian) vision, as professors, researchers and Ph.D students born and raised in Italy and currently residing between the latter and Spain. Therefore, some concepts may not apply to other communities or social groups different from those of the authors. Future research will investigate the geographic distribution of contributions and the most active scholars in specific themes, trying to validate or disprove the hypothesis that there is a marked Western bias generalized or in some specific topics. In addition, it would be our goal to deepen this literature review and make it systematic, using dedicated softwares such as Bibliometrix and VOSViewer. Also, we intend to undertake a thorough exploration of the main bibliographical references in the field, along with the results of the review.

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Being and Nature. The Aesthetic Ecocentrism

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Abstract

This article aims to understand how design aesthetics can actively contribute to a more sustainable and resilient society.

The methodology uses a tripartite analysis: literature review, case studies, and analysis of historical context.

The literature review was supported by an analysis of the philosophy of aesthetics and sustainability, case studies through examples of the ideals of ecocentric aesthetics and historical research as an ethnographic observation of the emergence of activism and its socio-artistic repercussions.

Ecocentric aesthetics is based on constructing an aesthetic language through sustainability, using “ugliness” to overcome social alienation by identifying beauty as the aesthetics of reception (mercantile pressure).

Propose through formal innovation, an activist role escaping the social functionalization of hyper-industrially, promoting a more conscious and accessible society, and a new language and knowledge that promotes resilience and preservation of life.

Keywords

Ecocentrism

Design aesthetics

Design theory

Circular economy

Sustainability

Introduction

This article aims to understand how aesthetics can promote resilience and the circular economy.

It resides under the hypothesis of ecocentrism as an ethical plan capable of guaranteeing the preservation of biodiversity and anticipating climate change. In its communicative urgency, it seeks an aesthetic suitable for the visibility of a new world. This means dealing with how humanity wants to experience its place. Aesthetics can play a crucial role, signifying ways of feeling and perceiving (Morton, 2007).

Form (aesthetics) results from two technical tasks: interpretation and communication; the first creative and the second productive. (Flusser, 2010). The form is the truth content (Adorno, 2020), it does not mean the outward appearance of which the content is clothed but rather the active, profound, determining and enigmatic principle of being (Suassuna, 1972). "Our analysis is directed at the claim objectively contained in its products to be aesthetic formations and thus representations of truth." (Adorno & Horkheimer, 2002, p. 20).

Design insists on drawing the form revealing meaning justified by the symbolic, functional and constructive dimension it attributes to it. It humanises the world and anticipates time, invoking an intention (Providência, 2015).

Design appears to question customs, technologies and mentalities as an aesthetic practice. A design object is not for pure contemplation (Pombo & Calvera, 2019); there are many aesthetic issues involved in our relationships with objects, some of which have ramifications: moral, social, political or environmental (Saito, 2007), countering the alienation resulting from the hyper industrial age (Stiegler, 2018). Aesthetics inform the mediation of Design's artistic objectivity (Francalanci, 2006) and is essential to the human capacity to imagine more sustainable futures (Lehtinen, 2021).

Design takes the role of creator of the artificial through an abductive investigation, designing the artefacts, devices and services for cultural mediation (Providência, 2015), acting as a symbolic mobiliser for the progress of the ideas that materialise, promoting the future.

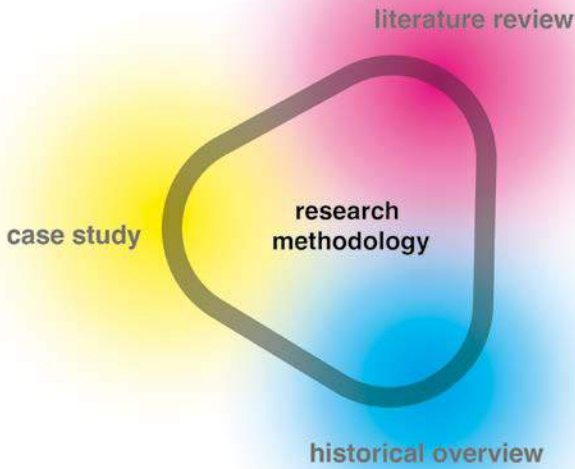
Is the discipline of concretion translating the collective imagination into forms through visual metaphors.

Aesthetics is knowledge through the senses that operate on the appearance of things. It is the way "things appear and is phenomenological, rather than structural, of the relation to what exists (Francalanci, 2006)".

Methodology

The methodology Fig. 1 used the analysis of the historical context (artistic, sociological and political), case studies and literature review, ensuring the triangulation of the information collected and its respective validation.

The literature review research focused on the philosophical nature of the issue, intending to find aesthetic theories in the context as proof of the defended thought.



The historical analysis looked at artistic, political and social movements that represent the overcoming of classical thought and constitute movements of change in social thought concerning the problems they faced at the time they refer.

Finally, the analysis of case studies looked for artefacts that conceptually and formally represent the thoughts defended in the aesthetic opportunity to be presented, allowing the construction of a theoretical argument through their interpretation.

Ecocentrism

Ecocentrism values environmental conservation through a system that preserves the integrity and stability of the bioethical community and emphasises the qualities of human integration as a constructor of artificiality (Pepper, 1996), “an ecocentric ethic always has a homocentric justification” Merchant (2005, p. 49). Aligned with the scope of *Circular Design*, aesthetics stands out as a research model and a form of knowledge, considering aesthetic experience as a form of knowledge (Geiger, 1958).

Reflections coming from ecology remind us that knowledge of nature demonstrates the power of human beings but reinforces the notion of its limits (Clément et al., 1994), and Design is the most powerful tool with which humanity has learned to shape environ-

ments [and, by extension, society and itself] (Papanek, 1972). The aesthetics of nature as an aesthetic theory requires us to reformulate the subject of aesthetics. It is a theory of perception, understood as the experience of immersion of people, objects and environments in a reconstructed nature. Ecology is a science, but the ecological is a symbol, a sign and provides an opportunity to reflect and rethink inherited patterns of thought and behaviour critically. From an ecological view, the relationship between the environment's qualities and the mood becomes the leading interest for aesthetics (Böhme, 2017).

It is about *Dasein*, the presence of things, artworks, animals and humans. Ecological aesthetics was motivated by our problems with nature, more precisely, by our problems relating to it. Human-kind's manipulation of nature shows signs of not being unlimited or unconditional. Humans are always dependent on nature. However, nature as a given is disappearing with the increasing technological advances (Böhme, 2017).

Sustainability refers to temporal resilience and durability in social, economic and cultural articulation. Consequently, there is, some friction between determining which elements should change and which should be sustained to increase overall sustainability.

This issue is of crucial importance in the sustainability transformations that Design may assist in making solutions more sustainable (Lehtinen, 2021), creating cultural, economic and environmental value, and offering more than they take (ensuring equity) (Penty, 2020).

From an aesthetic point of view, sustainable Design should aim to create durable objects that can be repaired, updated and reused (Harper, 2018), giving back to the disposable, consumerist condition of the market.

Only a design aware of its aesthetic dimension can participate actively, giving its interpretation to new problems (Calvera, 2003), not being hostage to its social functionalism.

Historical Context

Countercultures propose radical ruptures in art, science, philosophy and lifestyle. They advocate diversity and open communication, and the democratic sharing of their means of cultural production (Silva, 2018).

The poetic language of Dadaism annulled meanings and emphasised sonority, with the purpose that words simulated the urgency of a scream for revolt. The classical concept of beauty was replaced by asymmetry, disharmony, and disorder principles.

Now, questioning itself is used as a component of the work of art, especially after Duchamp's paradigmatic ready-made has come to have an interpretative character, opened up a logical divide between art and beauty, bridged by the Dada movement. In this gap between art and beauty, other aesthetic qualities, such as the Ugly, could emerge (Nolasco, 2010, p. 287). Nevertheless, the beauty in its aesthetic dimension surpasses the harmony to find in the dissonant the necessary truth (Adorno, 2020), admitting a new order.

The Dadaist art, or the Punk Movement, established the rupture with the established culture; the Dadaists grew, in the early

twentieth century, against all the standards of art, suggesting chaotic anti-art (Junior, 2015).

In the 1970s, artists viewed recycling as a method of material spiritualisation, constructing narratives focused on the idea of material dissolution in favour of a new existence based on the liberation of the useless in turn of a new utility (Eimert, 2013).

In the late 1960s and 1970s, these movements represented different socio-economic conditions, the urgency of safeguarding the ecosystem and mitigating the problems caused by the Anthropocene.

As an example, *Art Povera*, by dispensing with an end in itself, sacrificed its aesthetic dimension for an ethical functionalisation, demonstrating the complex connections generated in the world of things through the austere form using unconventional and “poor” materials, resorting several times to organic materials. Memory was a recurring theme, stimulating the observer to reflect on growth, death, dissolution, perishability and rebirth (Eimert, 2013).

The same is true of Land Art, using rocks and branches as raw materials. Wrapped in a romantic and ephemeral register of the presence of being, as a protest against the artificiality of life in the big city, opposing the “utilitarianism” of contemporary art, celebrating the smooth perfection of metallic and synthetic constructions. Indeed, the Land Artists’ search for the elemental experience, cosmic approach to the earth and desire for a timeless world mark their work as a modern variant of the back-to-nature movement (Abromson et al., 1973; Chilvers & Glaves-Smith, 2009).

Case Studies

Ore Streams, FormaFantasma

Ore Streams Fig. 2, Fig. 3 is an investigation by Formafantasma studio that transforms electronic waste into products, presenting various perspectives and reflections on the role of Design as an agent for the responsible use of resources.

Ore Stream raises awareness, through form, about the quantities of electronic waste produced (and discarded) and its mismanagement and low reuse.

Attributing an activist and reflexive dimension to artefacts, recalling the ugliness of alienated consumption, the rise of e-waste and digital consumption, they seek solutions to face more responsible management of the electronic society.



Conditions for Memory, Mel-Chin (1989)

Conditions for Memory is an installation of sculptures in New York's Central Park that intends to remind and alert the population to the extinction of the region's native species (The Sea Mink, Heath Hen, Passenger Pigeon, Labrador Duck).

Represented by the silhouettes, configured in an open mould as a representation of the impossibility of reviving these species. Furthermore, the various sculptures are accompanied by the extinction year as a reminder of the urgency of a paradigm shift.

Wallmakers

Wallmakers Architecture Studio is dedicated to constructing several buildings, having as a differentiator the use of unconventional materials such as clay, mud and waste and adopting Millennial construction practices for the construction of the structures.

They are concerned with using materials *in loco* (for example, the rocks used in the excavation) (About - WALLMAKERS, n.d.).

The Wallmakers studio re-establishes a connection to nature, positively taking advantage of its resources through an attitude of equity with the natural environment.

Campana Brothers

The Campana brothers develop various artefacts, with inherent environmental and social awareness, using waste materials and hand-made products, such as the Pirarucu collection made in leather with fish of the same name, caught locally and in a sustainable way.

Fig. 2
Forma Fantasma, *Ore Streams*, Table make to the exhibition *Ore Streams* using technological waste, Adriano Pinho, Museum of Decorative Arts, Paris, 2022.

Fig. 3
Forma Fantasma, *Ore Streams*, Detail of Table make to the exhibition *Ore Streams* using technological waste, Adriano Pinho, Museum of Decorative Arts, Paris, 2022.

Likewise, the Stuffed Toys collection, a collection of chairs made of stuffed animals and toys that appropriates “cuddly” products resulting from the industrial massification of a society (environmentally exhausted), denounces alienating *fetishism* by designing products that are humorous, mysterious and disturbing.

The case studies presented, therefore, constitute an aesthetic thought based on the idea of activist representation and the resignification of the artificial, reclaiming, through the idea of social, cultural and economic sustainability, the social fetishism of the time, through the conceptual innovation of its forms.

Aesthetic Opportunity

The Ugliness, the aesthetics of the Ugly, may offer the resistance capable of escaping the alienation of the pseudo “beauty” (aesthetics of market reception (Adorno, 2020) in the emergence of modes of subsistence.

The ugly is consolidated from Modernity onwards as a mode of protest and opposition to the conventions and traditions in force (Altaf, 2014)

“As a poetic work, the design will find its vocation to unsettle the world, questioning it as truth (Providência, 2012, p. 124), and in this sense, the ugly will not exactly be the opposition to the beauty “because its negativity is not symmetrically opposed to positivity”, but the urgency of an aesthetic of “immeasurable, all excess, everything that is not regulated, disciplined and contained” (Fianco, 2020, p. 11) characterising the experience of the new as truth until it is socially integrated consequently, neutralised as beauty.

The Ugly as works of art will allow capturing the meaning of life in the depth of human nature, offering the perception of the foundation of the disorder of the real, the natural and world vision in its beautiful and ugly qualities (Suassuna, 1972), being, therefore, its mission “to introduce chaos into order” (Adorno, 1951, p. 215).

The ugly is “inseparable from the concept of beauty”, becoming eminently mimetic and critical of the existing world (Ferrer, 2017, p. 232), restoring to culture the representation of the world, not camouflaging it with the sublimation of beauty but exposing it cathartically, highlighting all the ugliness of society (Adorno, 2020; Fianco, 2020).

Beauty will always refer to a sublimated society submissive to material consumption called “progress” (Nolasco, 2010, p. 59), contributing to unsustainability and environmental disaster.

However, forms communicate, and their aesthetics play a creative and activist role, enabling the conception of a new moral idea (Fianco, 2020).

Aesthetic values are thus released through the socially ugly (Adorno, 2020) since the “question of the aesthetics of form, is thus not limited to a mere problem of taste, but constitute an ideological and above all moral problem (...).” (Providência, 2011, p. 281), “[Design] is the free position of the essence of a world. However, historically, they are creations. Objects, in time, are facts of decision and condition of deciding morally on beauty. A theme: beauty; a

structure: to be free among fellow creatures.” (Lapa, 1968, p. 74).

Alienation is identified by Hegel as the divorce between “essence and existence” (Hegel, 1995; Macedo & Piccolotto, 2020) as if existence is trapped in a representation that distances us from our essence. It reached its peak not only due to capitalism (motivated by unconscious consumerism) but also due to the Modernity of technology; as stated by Benjamin (2010, 2012) and Flusser (2012; 2008), “The alienation of the spectator, which reinforces the contemplated objects that result from his own unconscious activity, works like this: The more he contemplates, the less he lives.” (Debord, 2005, p. 16).

The solution pointed out by Herbert Read goes through a recomposition of the human psyche through art. For Read (1968), only art can give meaning to existence, “not only in the sense of overcoming alienation [from nature, society, the self] but also in the sense of reconciling the being with its destiny (Macedo & Piccolotto, 2020).

The ecocentric aesthetic is a proposal for innovation, escaping the alienation of beauty in the search for truth, ignoring the beauty that alienates and promotes the oblivion of the being.

The rough, imperfect and “poor” form of the materials used, without finishing, restores the material consciousness of (living) being that cohabits biomes over which it does not dominate.

It is proposed then the definition of an aesthetic language of Design aligned with the thoughts of the Circular Economy and 2030 Agenda, allowing through the poetics of *brutalism*, truth and austerity, as opposed to sublimation, based on the construction of the survival of the planet and consequently of the human being.

Therefore, the sustainability of ecocentric aesthetics considers the processes of materialisation through the conformation of ideas promoting longevity, material economy, form and its meaning, “solving” the system’s problems and mediating communication with the remaining agents representing social conscience.

Art and Design are socially produced, a product of their time, but also a means of stepping back to speak against the institutions of society: “This contradiction is preserved and resolved in the aesthetic form which gives the familiar content and the familiar experience the power of estrangement” leading to the emergence of a new consciousness as well as new perceptions (Marcuse, 1972, p.41; Miles, 2016, p.8). The “estrangement” [ugliness] opens new critical possibilities, integrating the individual as an interpreter and key to resolving its enigmas.

Discussion

The proposal of this aesthetic language arises, from the need to find new ways of designing, with a view to a carbon-neutral society, ensuring the preservation of ecosystems and promoting local communities, equality and diversity, reminding the human being of his role as planetary manager.

The use of waste, austere forms and the reformulation of production processes will reveal a communicational form of activist resilience, allowing the cohabitation of all beings, guaranteeing the continuity of species and the survival of the human being.

Design will be [through aesthetics], an agent of change, building a better future, critically designing a safe planet mediating the various disciplines and reconfiguring artefacts, the economy and society (Rawsthorn & Antonelli, 2022)

The ecocentric aesthetic asserts itself as meta-design, “as an aesthetic contribution to the critical reformulation of society, thus increasing its life span, reducing the industrial impact [on nature] by incorporating more appropriate materials and more elaborate techniques, thus counterposing the deceleration of consumption for the conservation of biological and cultural diversity” (Providência, 2011, p. 280).

Therefore, the assumption of an ecocentric aesthetic language will represent new knowledge, fostering awareness through raw and austere forms and materials in the preservation of the ecosystem, which will create a rupture with unsustainable fetish patterns and alienation.

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Forward to the Primitive. New Sustainable Design Processes Characterized by Primitive Aesthetic

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Abstract

What will Design become if the object disappears, sublimating itself into the most sustain-able expression of form, that is its absence?

As part of a wider theoretical research on new models of effective product design, we want to emphasize how the growing integration of ethical and environmental sensibilities leads to an often-primitive approach to design that is capable of catalyzing concrete actions and triggering a new accessible aesthetic for the public.

What emerges is a process of progressive disappearance of the object in user practices, replaced by more intangible qualities and value components (ethical, cultural, ideological dimensions of the project), which are also investigated and enjoyed through new unexpected media supports such as videos, films, ambient happenings. This process sees the center of content production shift toward the market or the public and its “peripheries,” where a more natural instinctive and direct approach is often expressed in an essential, primitive language.

Keywords

Design process
Primitive aesthetics
Action design
New craftsmanship
Sustainability

Introduction

What will Design become if the object disappears, sublimating itself into the most sustain-able expression of form, that is its absence?

Within the framework of this speculative question is substantiated one of the most pronounced and evident transformations of design practice in the contemporary: we are now witnessing a progressive utilitarian devaluation of the object, accompanied by a new participatory interest in designing the future through actions (such as happenings), rather than through the use and consumption of the objects themselves. Indeed, on the one hand, this process is characterized by the progressive dematerialization of the product, which increasingly looks more and more like a service or a “fluid assemblage” (Redström, Heather, 2019, p. 30), on the other this is driven (almost induced) by the overexposure of design pathways leading to design, which are themselves transformed into products for eminently media-driven consumption about “how it is thought”. As part of the research, we want to emphasize how the growing integration of ethical and environmental sensibilities leads to an often-primitive approach to design that is capable of catalyzing concrete actions and triggering a new accessible aesthetic for the public. Through some case studies, workshops, and design experiences, we want to investigate and verify here which emerging models prove to be most effective and replicable.

Evolutionary Framework

In some ways, the call's urge to draw more sustainable scenarios pushes us beyond the Anthropocene and underscores the crisis of the majority of ecological thinking, from which almost all customary patterns of productive and market development derive. So far, humans and their needs have always been placed at the center of a modifiable relational ecosystem composed of living beings and exploitable inert resources. Firmly anchored in this existential conviction, homo-sapiens has evolved, protected, for long periods of the most recent history, from the specter of an ideological conviction based on an optimistic vision of development (linked to continue innovation) and the idea of the inexhaustibility of resources. At the same time, knowledge has grown, and a latent culture of the project has spread, within a relationship of mutual contaminant inference, capable of generating moments of reformism and rearrangement of development models.

Industrial production and a certain definition of design, although in transformation today, do not escape this pattern and indeed have sometimes proved responsible for hyper-production of objects, without corresponding either quantitatively or qualitatively to people's real needs and market demand. Industrial Design bears the responsibility of having characterized its disciplinary identity for almost a century (at least until after World War II) through its strong reflexive relationship with forms, materials, techniques and production technologies, almost without strategically weighing those intangible lateral qualities (such as the quality of demand, interactions with local cultures, synergies and trans-disciplinary contaminations),

which place and sustain the product within a complex and articulated con-text, solicited from many sides, in delicate balance.

Using a lateral philosophical approach, Tony Fry, in his recent book *Defuturing, a new design philosophy* (Fry, 2020), describes the topic of sustainability in relative terms as the *sustain-ability* of a system or a community, with reference to a product, a process or a development model. This version translates sustainability into a non-intrinsic quality of the object and rather refers it to an articulated contextual framework, in which social, cultural, ethical factors are as important as the material, technological and economic ones, which are more traditionally traced back to design. “While we are more then even aware of both the promise and the threat of technological progress, we still lack the intellectual means and political tools for managing progress” (Feenberg, 2002).

The trajectory of morpho-linguistic evolution from *Industrial Design to Design*, reflects at least the most recent part of this change, which originates in the transition from *Modern to Post-modern* and continues even further to the present, leaving space for a possible redemption of design. If we assume the late birth of Industrial Design as coinciding with the appearance and subsequent affirmation of Modernism in Europe, accepting its already evolved complex definition of “reason of the whole” formulated by Tomás Maldonado in 1961, we realize that its qualifying adjective (industrial) at some point slowly began to change, until it disappeared in the determination of “total-Design” (Dorfles, 1972) or in the more generic one of design. This process drew an inclusive parabola that progressively integrated soft qualities (ethics, communication, experience, etc.) and definitively dematerialized the object into a myriad of micro-projects, as Andrea Branzi states: “from product-design to buzz-design” (Branzi, 2007).

The reasons for design have remained largely unchanged over time, but its manifestations have changed as a result of technological (infrastructural) innovation and increasingly sophisticated marketing activities, which can shift the axis of the functional perception of a product and building scenarios at least as strongly as design. Andrew Targowski, a Polish American computer scientist and pioneer of applied information systems, in outlining his tripolar model (Mitrovic, Auger, Hanna, Helgason, 2021, p. 14), once again emphasizes the difference between culture and infrastructure, where culture is based on relatively stable values, whereas infrastructure changes over time in a largely additive manner, thanks to local graft and contributions, which thus cause its development to evolve in an almost unidirectional sense.

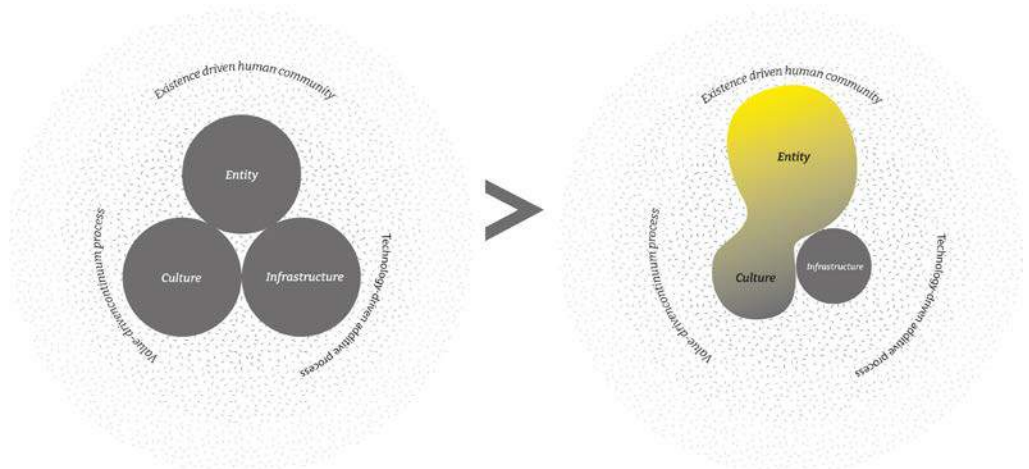


Fig. 1 Andrew Targowski's tripolar model identifies three driving factors behind innovation processes, each with different characteristics: culture, infrastructure, experience.

The historical, cultural, economic, social context variably influences each innovation vector and determines conditions of different inferential relationship, where today the experiential component prevails (in a certain sense with a participatory vocation), this places the project more and more inside the market, in close proximity with the user.

If we apply Targowski's model to the world of production and to what precedes it, i.e. design, we perceive the risk of a slow, technocratic, unidirectional and contaminated transformation, with respect to which, as mentioned, history punctually delivers episodes of revenge and success, mostly generated by an effort of at least cultural imagination, before being technological. Even more definitively, we can say that it is precisely the action exerted within the perimeter of culture that has always represented the sine-qua-non condition to produce visible and permanent development effects in each of the most important innovation junctures, whether or not accompanied by technological factors.

From Product to Process

According to some observers, the weakening of the materialist notion of design is an inevitable end in the face of the crisis in production and industrial systems, where the empty spaces of design have been rapidly recaptured by local communities of makers (which have sprung up spontaneously in the form of democratic actions of anarchic inspiration) and by a new craftsmanship of Anglo-Saxon origin (perhaps a residual expression of an Arts and Crafts vocation that is still alive). Faced with the crisis of capitalism and the object overpopulation on earth, the system is now driven by many small local editors, and it seems to react with idealistic signals, partly rejecting products, and turning its gaze into new contents and new forms of production.

While in the traditional production practice the object is the result of a synthesis process directed by a designer who works as a cultural mediator, now the object (sometimes self-produced)

grows-up directly in the market and so it is increasingly involved in the direct and democratic self-definition of the local fringes in the audience. In this new horizontal production pattern, the ethical, political and idealistic dimension prevails above anything else, to the point of blocking out or rather metabolizing the form without conditioning.

At the same time, another transformation has taken place: after the digital revolution, which slowly redefined the paradigms of production, distribution, consumption and perception of goods, there is now a mature interpenetration between the physical, digital and biological world, summarized in the concept of the fourth industrial revolution. The advent of *Digital Manufacturing* has shortened the distance that once separated the figure of the designer from the production environment. The designer now gets his hands dirty and becomes a direct-maker, creating an ever-closer link between the conceptual and the real, thanks to increasingly accessible and efficient tools. The design process itself (such as *Design Thinking*) changes in the face of the opportunities offered by Digital Manufacturing.

This transition, far from being a mere qualifying factor only for what precedes the appearance of the object on the market, finds definitive expression in the *phygital* model, in which the advanced level of development of digital technologies and the pervasive distribution of access points or protocols defines areas of proximity between the physical and digital worlds practically everywhere. In this sense, one can go so far as to define phygital virtually any experience, including those through which empathic involvement with the product is generated, on which choice and satisfaction, for example, depend.

Just as, according to the Nobel Prize winner Josif Brodskij, the eminently weak connotation of communism at the end of the twentieth century sanctioned the collapse of the Soviet countries, today the collapse of formal/materialistic hedonism in production and the simultaneous pervasive appearance of bottom-up design actions put the process (rather than the product) as a focus for Design.

The lack of interest in the product and, on the other hand, the growing interest in the act of realization (testified by the huge number of video-tutorials available on YouTube and the other social-networks) pushes the center of production towards the boundaries of the production system. In some way this often determines a more instinctive and direct design approach, at least when it is not mediated by the conscious action of a design-expert who draws on his own experience. Consumers today could not be seen as merely users but “they must become active imaginers. This is something people usually do when they visit museums to view historical artifacts on display, [...] more and more interested in using props to transport viewers’ imagination into a thought experiment” (Dunne, Raby, 2013, p. 93).

This aspect of change partly derives from extra-ordinary extra-social changes (or to put it in the words of the sociologist Bruno Latour “*from uncontrolled and uncontrollable events and actions*” - Latour, 2005, p. 59), like those that more than ten years ago Ezio Manzini identified in cultures and social groups crossed by contamination, which distort the meaning of Design and from which spring other knowledge, other needs, other project applications (Manzini, 2015, p. 48).

Case-Studies

Hypebeast is one of the leading online destinations for men's contemporary fashion and streetwear. In 2012 HBTV (the business television channel of the brand) decides to produce a series of videos searching, selecting and presenting the practice of a few Anglo-Saxon artisans and designers. Behind the choice and the production operation there is first and foremost an anthropological and behavioral intuition: that of a growing public interest in the backstage of the product, an almost morbid curiosity, expressed in latent form by the public, who, from the kitchen to the factory, from tailoring to the private of a home, increasingly seek confirmation or explanation of the origins of everything. An attitude so intense that it turns into an object of interest itself and eventually diverts attention away from the commodity, the form, the product.

In the series entitled *Modern Day Artisans* five young British designers (like the *Young British Artists - YBA* - who started exhibiting their work in 1988), Max Lamb, furniture designer, Sebastian Tarek, custom shoe maker, Ricky Feather, bicycle maker and designer, Jake Ferrato, custom shoe maker and Duffy Jewellery, jewellery designer, bring out a new dimension of craftsmanship and *DIY* (Do It Yourself) production, in which the aesthetic and value quotient of the hand-made product is finally elevated to a high level of seduction, thanks to the contamination of contemporaneity and tradition. In addition to a systematic access to the heritage of traditional knowledge, each time linked to the transformation of one or more materials for the realization of a product, each author demonstrates, just as methodologically, a natural ability to contaminate codified production processes with new product management tools.



Fig. 2
Max Lamb stands in his London studio behind a maquette for one of the 6x8 Chair, made from a single piece of western red cedar. The 6x8 Chair explored the tension between individual quirk and mass-produced form, the way that a singular maker can mimic industrial methods yet push against them.



Fig. 3
Max Lamb, one of the 6x8 Chairs (left) next to a Douglas Fir Chair originally designed for Acne Studios' Stockholm headquarters. The 6x8 Chair explored the tension between individual quirk and mass-produced form, the way that a singular maker can mimic industrial methods yet push against them.

Everything (from technology to communication, from packaging design to product customization) happens under the watchful eye of a video-camera and through a *rough* and casual projection of the processes and steps that accompany the birth of the product.

Again, Max Lamb emphasizes the search for extreme essentiality (a reduction of the product to its minimum terms) behind his project to reinterpret the campaign-chair, an example of *flat-pack furniture*, produced and well-known all over the world in a very basic version (the *Roorkee chair*, for example, was produced in India and it was used by the British Army since 1898). The version designed by Lamb for Dunhill seeks to reduce the product to its bare minimum, with obvious formal and typological consequences: more contemporary production declinations such as seams and joints disappear, in favor of a bare materiality made of wood and natural leather.



Fig. 4
Max Lamb, making of the campaign-chair designed and realized in 2011 in collaboration with Dunhill labs. The project originates from the designer's search for extreme reduction in form and workmanship around a Roorkee chair (an emblematic example of flat-pack furniture, produced and distributed since the late 1800s in India). The result will be a seat with a wooden frame assembled by dry-fit joints, seat and back in natural leather attached by a few metal rivets.

From the observation of the practices analyzed and many others, scattered all over the world emerge some constant factors, which we believe can take on a strategic value for the development of new forms of production of items with a low level of complexity and for the effective enhancement of traditional knowledge.

This escapological tendency of design, or rather of emerging contemporary design, from the system of deferred industrial production, in favor of processes of self-production, in which the continuous synthesis of thought and action takes place, proves to be more sustainable today and generates typological and morphological innovation in the direction of primitive simplicity.

The unprecedented interest in the processes of production and design, redefines the arrangement of the system-product (understood as "the set of contact elements between producer and customer, i.e., the organic and coherent whole of product, service and communication" - Zurlo, 2012, p. 33), which is increasingly complemented by the direct (or video-mediated) experience of making. This is a new offering intended to correspond to the growing voyeuristic curiosity of the public, partly replacing the fetishism of possession, and above all opening up an interesting prospect of development in the direction of an increasing aestheticization of processes instead of things.

Conclusions

After having freed the field of the project from formalisms and style exercises that are ineffective for the user or the modern public, another vocation for design remains, capable of creating value beyond form and function. As in a primordial landscape in which man (designer or user) is alone, the process and a necessary behavioral reflection become central, free from aesthetic and its materiality. This is the starting point

from which a new sustainable (or sustain-able) aesthetic arises, in which the physical manifestation of the product is systematized most of the time only in a second moment, while what immediately appears is the programmatic action (rigorously filmed) with which the designer (alone or in a group) fills the time and space of the present.

In an empirical way, the present research aims to highlight, in the work of some designers and in the in-Covid design experience, carried out within the course of Product Design of the University of Florence and University of Tuscia, constant traces and common denominators of a new methodological essentialism, experimented effectively in the production of new types of products. Within an almost neo-primitivist condition, we intended to isolate levers of design, performative, experiential action, capable of indicating new design topics and disciplinary scenarios beyond the Anthropocene.

Thus teachers, designers and researchers have chosen to operate consistently with the critical review just outlined, to isolate a minimum methodological apparatus through which to provide design tools adherent to a less formalist demand. In this sense, an experimental scientific approach was adopted, through which, starting from contextual conditions of limitation, a few but stringent instrumental constraints were added (Covid-1, comparable to those found in the case studies). The self-productive prerogative or the idea of limiting the number of materials or means at the designer's disposal has thus standardised the design process, facilitating access even for non-experts.

In this phase, the programmatic reduction of the designer's "traditional" operating field was compensated (but it would be better to say accompanied) by the parallel integration of new multimedia tools, which contributed to the preliminary and contextual planning of the design processes themselves and to the construction of a sensible component of the perceived value of the product.

From the video documentary, to the design of a digital product/service integration platform, to the planning of mass-custmization actions in the production processes: what emerges from the case studies and from the experimentation conducted are "dried" outputs in the formal component, which are however deeply updated in the meaning perceived by the public: a consumer, ethical and experiential value, increasingly expressed by rapidly evolving markets.



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Fig. 5

Gabriele Matteoli, Elisa Giliberto, Leonardo Cai, Scrub, series of bollards and street furniture made of precast concrete, a project developed as part of Prof. Jurji Filieri's Product Design 2 Laboratory course at the University of Florence Industrial Design degree program. The Project, developed during social distancing phase due to the first Covid-19 pandemic emergency, originates from a speculative conditioning of the brief, which traces the design act back to primitive actions of composition and transformation of matter. Courtesy the authors, the University of Florence.

“Therefore, it is not the ancient crafts to be pursued, but the profile and characteristics of the artisan” (Micelli, 2011, p. 64), today necessarily enriched by the ability to enhance the product also through the story of the processes from which it originates. In this framework design contaminates craftsmanship, repositioning his brand and almost creating a new form of participatory end-user militancy for the creation of an object.

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How Long Does It Take for a Paradigm Shift. A Design-Based Critical Essay on Materials and Fabrication Processes

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Abstract

Industrial development has shifted production economies towards the manufacturing of automated, cost and time effective, standardised and custom goods. However, such advancements seldom considered the degree of sustainability in transformation processes as the greater attention to environmental concerns only emerged in the last decades. In this regard, the objective of this paper is to provide a brief critical analysis on the transformation processes of matter and energy regarding the production of human artefacts within the domains of design and architecture. Theoretical frameworks derived since the XIX century are chronologically exposed and studied to display the cultural evolution of nature-oriented thought, outlining the current state of an environmental paradigm shift, instantiated by remarkable case studies. The presented concepts are expected to shape a historical overview of industrial sustainable approaches, promote discussion topics around consistently sustainable advances and instigate further developments towards potentially innovative emerging scientific and educational fields, such as biomaterials and biomanufacturing.

Keywords

Design
Sustainability
Education
Fabrication
Biomaterials

Introduction

The progressive and cumulative consequences of the four industrial revolutions taken in the last centuries have been felt with increasing magnitude. Although recent transformations of industrial and technological processes have evolved and allowed new ways of transforming matter and energy through computer-aided design and manufacture - CAD and CAM respectively (Caldas & Duarte, 2005), such processes are still not ideal (Bechthold, 2016) as they do not promote the rationalised use of material and energy resources and, therefore, generate waste. The direct impact it has on mass production of goods and standard economic frameworks, such as linear economy, demands greater attention towards questioning how matter and energy could be better transformed and consumed.

Design and Industry: The Sustainable Reframe

The industrial transformation of matter into goods and services is responsible for 22% of global energy consumption (IEA, 2013). Manufacturing processes that generate waste in large scale production, such as Computer Numerical Control (CNC) applications, are instances of environmental failures precisely because they do not reinsert or reuse the wasted material as well as consume large amounts of energy. Therefore, the converting industry is one of the main sectors in which the activities carried out need to be contextualised within the scope of sustainability (WCED, 1987).

The acknowledgement of environmental performance failures in highly industrialised practices, such as architecture, engineering and design, leverages climate change and natural environment growing crisis as increasingly frequent guidelines in several fields of human action. In this sense, a new dimension of design attributions has emerged in order to assess the ability to optimise the quality of human life without causing negative impacts on the maintenance of natural ecosystems (IUCN, UNEP, & WWF, 1991), namely the degree of sustainability (Myers, 2018). At the same time, the increasing technological development of new computational design and evaluation tools have fostered the advancement of more integrated, informative and interdisciplinary collaboration design (Kolarevic, 2003, 2008) and manufacturing approaches. A paradigm shift arises (N. Oxman, 2010) focusing on material characteristics and set by scientific studies on its properties and subsequent experimental applications (Menges, 2011).

In such an emerging paradigm, the artificial domain can be brought closer to the natural one, which means approaching the design intention and technique to the ecological use of material resources. The historical notion of creating a harmonious artificial environment with low environmental impact through design is further refined (Di Bartolo, 2000). It is directly related to design methodologies and the choice of production processes. In the field of architectural design, only a few decades ago, theories began to question the impact of the material in the design process. Even so, this is a topic that demands greater attention from architectural theory, research and practice, as it is commonly overshadowed either by

the attention to the stardom of 'starchitects' or the restricted teaching of formalisms. One of the contemporary theories that has mostly supported the development of scientific investigations in architecture is the New Structuralism: the procedural sequence, within the traditional design logic, of form-structure-material is criticised and reversed to material-structure-form (R. Oxman & Oxman, 2010). In the field of object design, the detailed attention to materials in terms of social and environmental impacts seems to be a more discussed and instilled topic in the essence of the discipline. It is traditionally understood as an operator that serves the structuring of a complex system through the management of its intrinsic properties by the designer, whose objective is to drive towards the functional performance optimization of a product (Manzini, 1986 apud Alarcón, Celaschi, & Celi, 2020).

From Inspiration to Ally: Design With Nature

Acknowledging the common notion that sustainability concerns the minimum or zero impact on the natural environment, the observation and analysis of the functional, organisational, material and structural relationships of natural phenomena can support the development of design methodologies in analogy to natural system's processes (Alarcón, 2003), turning them much more sustainable (N. Oxman, 2010). Historically, the disciplines of architecture (Bahamón, Pérez, & Campello, 2008) and design (Emami, Tashakori, & Tashakorinia, 2008) have consistently relied on Nature in search for inspiration and solutions of maximum performance and minimum consumption of resources (Di Bartolo, 2000; N. Oxman, 2010). This demands interdisciplinary approaches, especially with the discipline of Biology.

During the 19th and 20th centuries, the use of biological analogies in the design field took place predominantly within the scope of visual language. Approaches and methodologies within what Di Bartolo (2000) classified as Basic Design, or also Bio-inspired Design (Fu et al., 2014), present an evolutionary development with regards to higher rigour standards with which information is analysed, processed and synthesised in the design development.

Formalistic bio-inspired analogies have developed firstly from rhetoric to visual abstraction and later to process analogy. In the 1920's and 1930's Germany, "Biotechnik" was regarded as the science of adapting natural structures and processes into technical artefacts (Margolin & Buchanan, 1995). This term was "exported" to the United States of America and deployed there during the 1950's and 1960's as "Bionics" to classify design inspirations in natural processes for the development of potential innovations of artificial materials for practical applications (N. Oxman, 2010). At the same time, the concept of "Biomimetic" emerged in academia, designating the study of solutions to design problems from the conversion of natural processes. In 1997, Janine Benyus proposed the terminological variation "Biomimicry" to refer to the discipline that studies the models of nature and converts them into solutions to design problems (Benyus, 1997).

Despite the sustainable intention in all these approaches, all present is an excessive focus on the exploration and development of

the design technique employed rather than consistent real applications that consider the impact of the manufacturing process in terms of energy consumption and material life cycle.

Joris Laarman's Bone Chair (2006), for instance, is designed with high-end design technology to emulate the performance of material and structural demands in bones, and manufactured by steel casting process, not involving wear and tear and material waste. However, such a process involves high levels of energy consumption for its viability, which ends up making the product environmentally inconsistent.

A more consistent computational biomimetic design example that answers the material and environmental concerns more satisfactorily is HygroScope: Meteorosensitive Morphology (2012) by Achim Menges in collaboration with Steffen Reichert. This is a scientific and experimental climate responsiveness application in which a solar protection system is devised from material's behavioural system, excluding the use of mechanical or electronic control (Menges & Reichert, 2012). However, it is important to notice that material technologies are not necessarily linked to state-of-the-art technologies.

Towards Biomanufacturing

Noticing the advantages of prioritising material over form and style, some approaches have recently emerged in theory and practical experimentation with the aim of replacing 'process emulation' by 'integration' in new composite and biopolymer materials (Myers, 2018). These kinds of approaches are broadly categorised under the term "Biodesign" (Esat & Ahmed-Kristensen, 2018) and propose the replacement of industrialised processes by living organic material or biomass (by-products and waste from current industrial production). The objective is devising new materials that, when reinserted into production lines, are likely to promote a global decrease in energy and raw material consumption (Myers, 2018). This is a more consistent approach to the sustainable premise of minimum consumption of resources to generate maximum performance (N. Oxman, 2010).

A recent and innovative case study is the project "Reclaimed Assets: from fibrous waste to sustainable design material" (2018), led by Nataša Perković at KYOTO Design Lab. This project's main objective was to reuse waste biomass from palm oil processing in the creation of a functional material. Its exploration was contextualised in two technological production categories: the first one, a high-tech process, by additive manufacturing [fig. 1] and the second one, a low-tech approach, by traditional paper manufacturing technique [fig. 2] (KYOTO Design Lab, 2018). It is important to notice that reintroducing previously processed materials into a production line highlights the brutal amount of energy potential wasted in conventional manufacture. At the same time, the project values ancestral and vernacular production techniques, promoting the union, through study and material innovation, of the past and the present.



Another case study that proposes an innovative and biodegradable material is the BioBomber Jacket (2014) by BioCouture's founder and researcher at the School of Fashion & Textiles at Central Saint Martins College of Art and Design, Suzanne Lee. In this project, bacterial cellulose is produced by combining yeast and bacteria through a fermentation process, which generates an elastic tissue with properties similar to leather, but compostable and with low environmental impact (Fairs, 2014). Both in BioBomber Jacket and in Reclaimed Assets, it is possible to verify that the related production processes are much less aggressive to the natural environment than those currently practised in the industry.

Lastly, Bioconcrete (2015), a project developed by microbiologist Hendrik Jonkers, incorporates bacteria and calcium lactate into the concrete mix. While the BioBomber Jacket makes use of materials obtained from bio-chemical processes, Bioconcrete incorporates bacteria and calcium lactate into the concrete mix. The interaction of bacteria, moisture and calcium lactate produce calcite to fill the cavities of cracked concrete, recovering lost material and mechanical resistance (De Belie, 2016). Despite expanding concrete's life, this project does not bring any changes into the production process and, therefore, does not contribute to the reduction of the current 8% emission of carbon dioxide in the atmosphere by the cement industry (Nature, 2021).

Nevertheless, the potential that biomaterials have on contributing to a structural shift of current environmental conditions will in fact be effective if there are two associated dimensions of applications. The first dimension refers to the development of characteristics and capabilities of the material itself, mainly functional exploration, considering the reinsertion and the reuse of disposable material. The second dimension refers to the choice of available manufacturing processes that consume lower energy levels and

Fig. 1
Nataša Perković and
KYOTO Design Lab.
Reclaimed Assets, chair
fabricated by additive
manufacturing. Photo
Credits: Tomomi Takano.

Fig. 2
Nataša Perković and
KYOTO Design Lab.
Reclaimed Assets, traditional
paper technique
chandelier production.
Photo Credits: Tomomi
Takano.

corroborate to reduced carbon footprint, or even the development of new manufacturing technologies that incorporate sustainable and environmental constraints in its conception and application.

As an instance, the recent technical-scientific development of Additive Manufacturing technologies has incorporated the evaluation of performance related to consumption of resources, waste management and pollution control, in addition to 'economic', 'social' and 'environmental' dimensions to the concept of the 6Rs: reduce, recover, reuse, redesign and remanufacture (Peng, Kellens, Tang, Chen, & Chen, 2018). Olivier Van Herpt, for instance, is an industrial designer who approaches ceramics through additive manufacturing (Van Herpt, 2020) and explores its potential without generating major energy impacts.

Such development of circular economy materials and cleaner manufacturing processes are a great potential towards consistently accomplishing some of UN's sustainable development goals, like creating correct means that ensure the sustainable consumption and production patterns (United Nations, 2015). At the same time, as there is also a need for a cultural dimension to production, traditional and vernacular techniques, commonly more sustainable than industrial ones, are also practices being valued and perpetuated in the design and architecture activities, so they can contribute positively to the sustainable transformation if integrated with research on new materials.

Conclusion

The degree of material and manufacturing sustainability in current design applications is a feature to have a critical eye on. They can be seen as evidence of how recent environmental awareness is assimilated in professional practice, commonly concerned with financial performance rather than with real sustainability concerns. At the same time, there is an increasing number of robust scientific investigations in design, engineering and material science aiming to corroborate an effective environmental paradigm shift. However, the feasibility and implementation of such a significant change of context demand transformations in the spheres of culture, means of production, market interests and international agreements, like Paris 2030 and UN's sustainable development goals, which precede the concept of sustainability. In the late-capitalism era, it is not a coincidence that the degree of sustainability still underperforms. Even though there are alternative options to fossil fuel (and their by-products) and to high energy consuming manufacturing, such as vernacular and traditional processes or even high-end robotic production, the steady development of an ecologic ethos towards existing or innovative materials and manufacturing processes is restrained by market interests. This makes room for 'sustainability' to be opportunistically taken as marketing and branding cases, thus blurring real sustainable practices with greenwashed entrepreneurial activities, which corroborates the low perception and underestimation of the problem in the mass society.

For a solid sustainable paradigm shift to take effect, either it will be necessary to do actual efforts towards the alignment of

industrial, political and economic activities, thus remodelling market interests towards environment oriented governmental policies and international agreements more efficiently, or we will have to overcome the current economic and political system that builds on over exploitation of natural and human resources for financial performance rather than providing any room for the advancement of consistent sustainable development applications. In both cases, education towards ecology and, perhaps more urgently, political and human rights as a society is the greatest tool to be used in such a global sphere problem.

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Sustainability Needs Service *Efficacy*

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Abstract

Today it is increasingly necessary to talk in terms of a circular economy. Design contributes through different disciplines by intervening in materials, production processes and product life cycles, but also through the design of services that develop models of exchange and reuse. The paper illustrates the contribution of service design in the implementation process of the *Efficacy* project. The first objective of *Efficacy* is to optimise the collection of bulky waste, through the development of a platform that catalogues and recognises the type of waste through its image. The second goal is to build an infrastructure to intercept the goods before they reach the landfill. *Efficacy* project is connected to the *Surpluse* reuse and repair centres, because *Efficacy* needs *Surpluse* spaces/social communities, otherwise *Surpluse* needs *Efficacy* digital process/social network to improve the network and service offer.

Keywords

Reuse

Service design

Circular economy

Ecological and digital transition

Behavioural changes

Context: The Circular Economy

For many people, the circular economy has been identified with waste recycling. But recycling is the least sustainable of all the circular economy activities, in terms of profitability and resource efficiency (Thackara, 2006). If we define a circular economy as all economic activities to extend the service life of goods, components and materials, through reuse and re-marketing, repair, re-manufacturing and technological updating of goods, it has always existed. The reuse activities have been perfected by operators in the *performance economy*, how to say Stahel: "In addition to design and reuse, the performance economy focuses on solutions instead of products, and makes its profits from sufficiency, such as waste prevention" (2016, p. 436). The second-hand market is constantly increasing even if there are no incentives and it isn't fully regulated, thus representing an underground market involving 23 million Italians in buying, selling and exchanging goods for a value of 23 billion equal to 1.4% of GDP (Bva Doxa, 2021). This trend is in line with the 2030 Agenda for Sustainable Development of the United Nations, in fact the 12th SDG, target 12.5 is described with these guidelines: "ensures sustainable consumption and production patterns, plans to reduce waste generation through prevention, reduction, recycling and reuse" (United Nation, n.d.). Europe is on track to become the first climate-neutral continent by 2050. Among Next Generation EU's goals there is *Make it Green* where it's possible to find different kinds of behavioural recommendations like "everyone can do their part [...] by buying second hand, recycling and reusing" (Next Generation EU, n.d.).

Within this context, the paper is focused on the *Efficacy* project, where the Architecture and Design Department of the University of Genoa is involved as a subcontractor to design a possible strategy for the application of re-use practices through the promotion of services that can foster the ecological and digital transition. The project is financed by the Regional Operational Program (POR) 2014-2020, co-financed by the European Regional Development Fund (FESR), that identifies the Liguria Region strategic priorities and objectives, for a multi-service, cloud-based ICT platform for the recycling and reuse of bulky solid waste in the urban area of the Genoa metropolitan area. Efficacy within Axis 1 - Action 1.2.4 - Poles of Research and Innovation has obtained funding in March 2021, presenting a proposal involving 7 subjects in partnership led by Amiu SpA, with different roles such as GIS mapping, waste collection, software design and data management (Amiu, n.d.). Amiu SpA is the company responsible for waste collection and management services and urban hygiene in the city of Genoa. The other partners are Algowatt S.P.A., Camelot Biomedical Systems Srl, Gter Srl, Circle Spa, Colouree Srl and Flairbit Srl. The primary aim was to create an IT platform that uses innovative technologies to catalogue data and make the system more functional and effective. A citizen who wants to dispose of a piece of furniture must take a picture using his smartphone which is read to derive a set of data and give some information. Then the software can manage and obtain details based on materials, size and weight, to organise and improve the collection. Finally, the data, using GIS, take on new value thanks to geographical positioning, which allows a better strategy to be defined for the

movement of bulky collection vehicles. In this project, it was important to shift the idea of channel/touchpoint, in this case the platform, from the channel as destination to the channel as an enabling moment (Risdon & Quattlebaum, 2018). The new goal of *Efficacy* is to create a virtuous path in the perspective of a circular economy, which aims on the one hand to optimise the bulky waste collection system, and on the other hand to activate a recovery and reuse process by intercepting the goods before they reach the landfill. In this field, design is systematising specific tools to manage actions in favour of the circular economy. One example is the dedicated Circular Design space within The Ellen MacArthur Foundation (n.d.). In this project, the discipline of service design comes into play, where design and its tools become a support for systematising different actions within the system (Meroni & Sangiorgi, 2011). Specifically, service design is also based on collaborative consumption models (Botsman & Rogers, 2010), with the aim of co-designing infrastructures with others in which sustainable actions can take place. On this subject, the research intends to trace the features of these economies characterised by models of C2C sharing economy, digital and material marketplaces, to converge all these unsystematized exchanges in a catalyst service of reuse and repair practices that can evaluate, reward, promote the swap power of citizens as the most useful way to reduce our impact on a planet. The head of the project Tiziana Merlino summarises the objective of the project in these words:

Just imagine having a bulky piece of waste and being able to give it a chance to not simply be thrown away. Just imagine being able to make it useful to someone else and thus being able to “live another story”. All while limiting pollution from cargo vehicles through optimization of logistics and transportation time. And this is through the application of information technology that can recognize different objects (Merlino, quoted by Amiu, 2021, tda)¹.

Methodology of Efficacy

The methodology is divided into three main phases: problem setting, scenario development and prototyping. In the first phase of problem setting, it was necessary to develop an examination of the strengths and weaknesses of the current doorstep collection system for bulky goods, as a result of a matrix of external customers and internal company points of view. The multi-disciplinary aspect of the project required alignment on the different steps from the outset. Through focus groups, it was possible to visualise and systemise the contributions of the different partners for a systemic self-assessment. In the Genoa area there are four different types of bulky pickup: Ecological Island, which is an urban free entrance area for citizens, dedicated to collecting different kinds of waste; Ecovan, a vehicle that stops for a while in a square or street in a neighbourhood to allow citizens to bring in items they no longer use; the home or street level collection, activated through a call reservation and scheduling an appointment Fig.1.

1
Original text “Immaginate di avere un rifiuto ingombrante e di poter dare a quest’ultimo la possibilità di non essere semplicemente gettato via. Immaginate di poter far sì che risulti utile a qualcun altro e così poter “vivere un’altra storia”. Il tutto limitando l’inquinamento dei mezzi da carico attraverso l’ottimizzazione di logistica e tempi di trasporto. E questo grazie all’applicazione di tecnologie informatiche che sappiano riconoscere i diversi oggetti”.

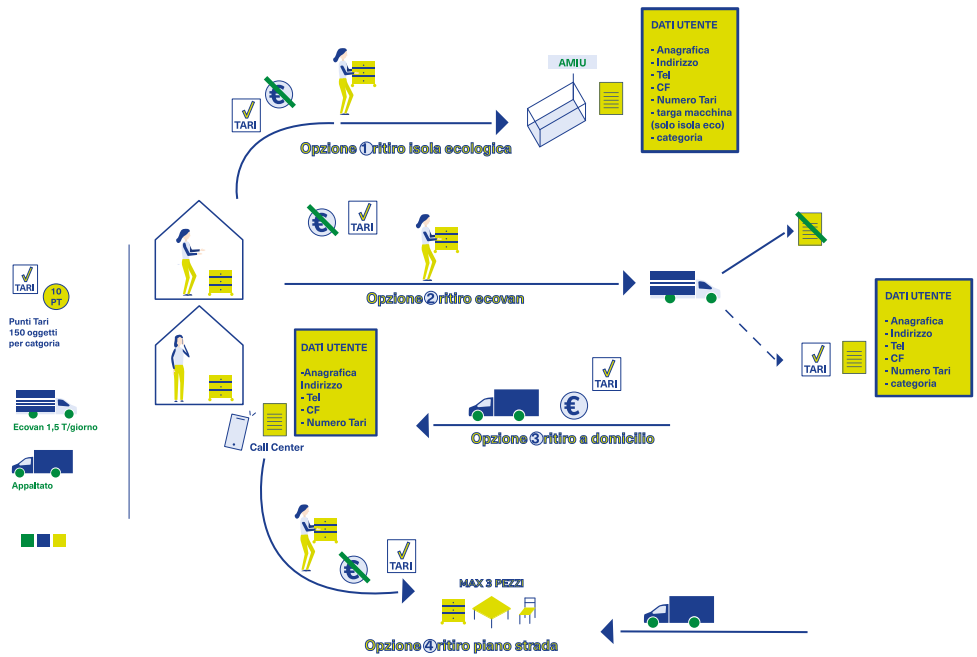


Fig. 1 Visualization of cluttered pick-up systems of the Amiu collection service used for different surveys and swot analysis.

These different modalities were examined by creating and sharing a visualisation of the different processes in comparison. For the moment the project currently focuses on door-to-door collection, as the most manageable mode for waiting time. Because the only one that requires a reservation and therefore contact before making the transition. To understand Amiu's perspective, it was important to start with an analysis of the four bulky waste collection systems. Each of these systems addresses the needs and requirements of certain targets, the aim was also to understand how and which system is most suitable for the project, but also what the future scenarios might be. For this reason, the local Amiu operators placed post-its on the four visualisations representing the different types of collection to better consider each phase. The colours of the post-its corresponded to categories: strengths, weaknesses, opportunities, and risks. Based on the results obtained, it was possible to reconstruct a SWOT Analysis according to the standard visualisation. At the end of the meeting, it emerged that there are not enough spaces and personnel resources to commit for the reuse, so the project must leverage the digitisation of the service to optimise both collection and reuse awareness. To understand the position of the citizen/customer, two surveys were prepared to be distributed over a month. The first one to observe citizens' views on their knowledge and evaluation of bulky waste collection, a service managed by Amiu, and what is the awareness of reuse. This was disseminated through the company's social network and UniGe's contacts. The other aimed more directly at those who already use the service to collect opinions and suggestions, and answers regarding reuse, a kind of customer satisfaction. The latter was distributed after the service through the call

centre or during the service near the *Ecovan* and Ecological Island stops. An interesting result emerged is that users are aware of reuse platforms, but rarely choose them before disposing of their goods, because they consider them a waste of time and because they do not consider the option of repair or reinterpretation for items that do not work or are no longer needed. Thanks to the systemization of this data, an overall picture of the pain points of the current system emerged, allowing for a different framing of the initial problem. During *Efficacity* development the team involved - thanks to our support - change the first mission identifying effective reuse practices as the first real contrast to waste production. Through reshaping the problem setting, the designer's role shifts from solving the problem to redefining it (Diefenthaler, 2008). The starting problem was examined from different perspectives and then the solution was structured around the real weak point. The opportunity is to not only improve the efficiency of the procedure but to design a private-public co-responsibility. It is necessary to focus on a change of perspective, to consider a futile object for an owner, useful for another one and vice versa, allowing it to live another story, thus transforming from waste to resource. The IT platform focuses not only on tracking waste but also on reducing its impact on the environment. The real challenge is to choose the practice of reuse as a necessary and compulsory step before the landfill, thus focusing on waste prevention to promote the circular economy and environmental sustainability. The digital tool is the infrastructure to make virtuous behaviour implicitly convenient and rewarding. The second phase was the co-design of possible scenarios, discussed and analysed punctually in every single step both in the project team and with technical operators inside Amiu company. These "project simulations" (Manzini & Jégou, 2004, p. 204) made it possible to discuss the different elements of feasibility in the short and long term. The scenarios, mixed with the journey map tools, have been made shareable through synthetic visualisations. As Morelli says:

The design activity heavily relies on visual representation, which is critical in communicating a project to clients, in verifying the validity of the project, and in generating a plan that can be understood and executed by other actors involved in the design process (2002, p. 13).

The visualisation can level out the excessive specialisations that do not allow an overall view and encourage the formulation of cross-cutting and effective solutions to be tested in the next phase of prototyping and testing.

The Pilot Project: The Link With Surpluse

In the third in-progress phase of prototyping, a pilot area has been chosen to work together on territorial logistics and the needs of a range of users and to be able to implement design solutions developed both on a digital level, thus testing the user interface and on an analogue level verifying the effectiveness and feasibility for the urban area. This project becomes a link to the system of *Surpluse* reuse and repair centres active in Genoa - conceived by Amiu in a Force project (<http://www.ce-force.eu>) as a territorial system of spaces

for collection and repair - becoming a mutual and complementarity resource/touchpoint for a better service for citizens and therefore a potential format exportable to other cities. Fig. 2, Fig. 3



The name *Surpluse* is derived from the union of the words Surplus+use and was born together with the brand and corporate image during a workshop at the Architecture and Design Department, University of Genoa (Fagnoni et al., 2022). These centres have different sizes and are identifiable by different colours: *small* (light blue), *medium* (purple) and *large* (magenta). The visual identity, which identifies the different possibilities, aims to create a sort of *franchise* to spread a culture of reuse and reuse of objects throughout the city's neighbourhoods. The aim is to make citizens the main actors in this process, giving them the tools to direct their actions towards the circular economy. The first centre launched was in Coronata, a district of Genoa, in October 2020. The centre is managed with the shared administration tool called "Patto di collaborazione - Covenant of Collaboration" signed for the first time by: AMIU, Municipio Medio Ponente, Amici di Coronata, ARCI ragazzi APS, Associazione Pro Loco Cornigliano. The furniture for this centre was made by the Labour Education Centre Lab 85 from recycled wood, which was made available by AMIU, based on a project by the Department of Architecture and Design, University of Genoa. In summary: *Efficacy* research needs *Surpluse* spaces/social communities, *Surpluse* needs *Efficacy* digital process/social network to improve the network and service offer. The digital part of the *Efficacy* project becomes a fundamental support for *Surpluse* centres. On the

Fig. 2, 3
Inauguration of the
Surpluse centre in the
Coronata district, Genoa.
Credits by Chiara Olivastri.

one hand, because it would make it possible to digitally record exchanges, to account for how many and which types of items are left and how many and which are withdrawn, to have a wider showcase of the products available. On the other hand, the *Surpluse* reuse centres become the analogue spaces of *Efficacity*, which can be used, for example, as a storage area, even temporarily and to meet different citizens needs as emerged in the analysis phase. Once you have the data you can put a concrete value on the process and consequently you can evaluate a whole system of incentives and rewards, systematising them with other reward systems already in use. Digital space and data collection also make it possible to monitor the quantity of exchanges, the materials most put back into circulation, and even to quantify the amount of Co2 saved, as Swedish Environmental Research Institute calculated for the second-hand platform Subito.it (Economia circolare, 2021). Being able to measure and value these exchanges is very important. Consequently, it was decided to design the prototyping and testing phase with the citizens' and associations gravitating around the *Surpluse* centre. As a first step, a focus group was organised to evaluate the results and dynamics activated one and a half years after the inauguration, but also to discuss the problems and future visions. It emerged that *Efficacity's* digital infrastructure would be very useful to the *Surpluse* centre. However, support from operators with digital skills would be needed because currently *Surpluse* is run by voluntary retirees. The digital transformation of some services is increasingly necessary, in this transition the service designer is given the role of managing the interests not only of the user but of all the stakeholders that become part of the system (Tassi, 2019). The acceleration of these processes must, however, be accompanied by a social and relational focus on the contexts in which the service is embedded. In addition, *Surpluse* centres have the possibility of becoming social spoke, where proximity and relationships can be practised (Manzini, 2021). The social role of these spaces is already very evident, and it is the spirit with which they manage to exist and resist.

Results & Conclusions

Service Design's mission is to frame the initial problem from the right perspective, to avoid the development of apparent solutions based solely on digitization, but rather new patterns of behaviour are found, that use technology to be more widely deployed. The role of designers is to infrastructure value co-creation, which means suggesting tools for activating customers' own cognitive and creative resources, intercepting users who are sensitive to the issue and to enable them to act in a more sustainable way. In this context, design can play a role in generating elements of change that have the potential to trigger larger systemic changes, for instance, by scaling-up local initiatives, thus working from a lower scale — a community or a small institution — to larger contexts, such as a city administration or national policies (Morelli, 2020). The tools and the different strategies, the survey and the visualisation of the journey map/scenarios allowed the sense and the meaning of the project. For example, the effort was to understand how the project and the platform are

positioned to existing platforms. The utility of co-designing with the waste management company made it possible to act directly on an existing waiting time before the object goes to landfill and convert this time into something else. The last ambitious goal is to develop a service that allows, from the individual citizen to the company, to create its profile about sustainability, able to collect, measure and reward virtuous actions. The hope is that single actions can be converted from good practices to co-responsibility necessary behaviours for our planet. An interesting result was to connect and link realities already active in the territory. It often happens that through calls and fundings interesting actions are activated in the area, but they do not always manage to endure after the end of the project. Being able to start from the existing and optimise the resources already active takes on a new value, in this way helping each other. Several projects related to the circular economy are being set up in Liguria, and there is a growing need to connect them so that one becomes a stimulus and support for others, the network is an invaluable resource.

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Systemic Design Applied to Medtech. Guidelines for Corporate Training on Sustainable Healthcare

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Abstract

The purpose of this paper is using the potential of Systemic Methodology to define the contents of a sustainable training course for companies in the healthcare system.

In-depth research of the current state in the art of the healthcare sector revealed the main critical points, on which to focus in order to develop project opportunities.

The involvement of a cluster of companies as a reference case study, the bioPmed cluster, was crucial to properly implement the desk research. Comparing the state of the art with a tangible experience closer to the needs of MedTech companies, the training audience, was the goal of this important analysis phase.

The paper is a starting point for a wider European project (Systema), which is involving international clusters and aims to realise the outputs of this research by designing a multi-stakeholder platform.

Keywords

Sustainability

Healthcare

Sustainable transition

Corporate training

Systemic design

Background

3 million is the estimated number of masks used in every minute by the world's population, 450 the years needed for their decomposition (rem ecologia,2021).

The global Covid-19 pandemic has generated a health emergency that has overshadowed the problem of global pollution, but waste disposal and resource optimisation seem to be critical issues still unresolved.

Personal protective equipment is just one example of how the healthcare sector, unlike others, is not yet ready to make the transition to greater sustainability. Transition that is needed to emerge from the current environmental crisis. Therefore, a cultural, design and management paradigm shift by healthcare system's actors is of paramount importance; new training tools are needed to be able to consciously re-design the healthcare system through a more sustainable vision.

The European Commission recognises the need for transition, promoting healthcare systems that are effective, accessible and resilient (2014). From the 90s onwards, people began to talk about the flourishing potential of sustainability in the sector.

However, Sustainable Healthcare issues have only really taken off in recent years.

To this end, there is a need for a dialogue between disciplines towards a common goal: a new concept of healthcare that is sustainable and circular, with an impact on people's well-being.

Furthermore, the Healthcare sector is a huge and articulated field, which presents a distinctive internal complexity due to its relevance and the logics that guide it. Healthcare encompasses very divergent realities that participate in different ways in the care of patients: from the production of tools and equipment, to the ward staff who assist in the hospital, and the healthcare waste management sector. The sector is constantly changing, from the research of better treatments and new technologies, to approaches adapted to the new needs of individuals and society. In this framework, the need has emerged for "a multi-level planning process that enables the implementation of socio-technological solutions capable of responding effectively to the real needs of the multiplicity of actors involved" (Pereno, 2020). Among the new trends in the sector, the theme of 'Sustainable Healthcare' has been gaining ground in recent years, with management of the sector more closely linked to environmental, social and economic sustainability. However, the sector appears to be out of date on sustainability issues compared to other industries and, as a result, has difficulty in translating this approach into more sustainable choices at various levels, from the national sphere to the territorial level of individual companies.

Goal of the Research

The aim of this research -Master degree thesis at Politecnico di Torino- is to use the potential offered by the systemic methodology to define the contents of a training course in order to enhance the sustainability of companies in the healthcare sector. To do this, the

first objective is the study of the European health sector overview in order to understand its constraints, dynamics and criticalities. The second objective is the definition of the training contents and how to deal with the issue in the healthcare sector, including suitable methods and tools.

The Role of Sustainable Healthcare

“Sustainable Healthcare” is seen as the application of sustainability principles to health. The health sector, until now, has mainly focused on the economic aspect, also due to its complexity (European Commission, 2016). In order to pursue Sustainable Healthcare, it is essential to take into account all three spheres of sustainability (economic, environmental and social).

Until now, the concept of Sustainable Healthcare (SH) itself does not have an unequivocal definition, nor a defined explanation of how to achieve or apply it in the sector (Braithwaite et al., 2019; Fischer, 2015, cited in Pereno, Eriksson, 2020). There is therefore an urgent need to develop knowledge-building strategies and identify the most suitable tools for international dissemination of sustainable healthcare issues, while strengthening scientific and academic knowledge of the topic (Pereno, Eriksson, 2020).

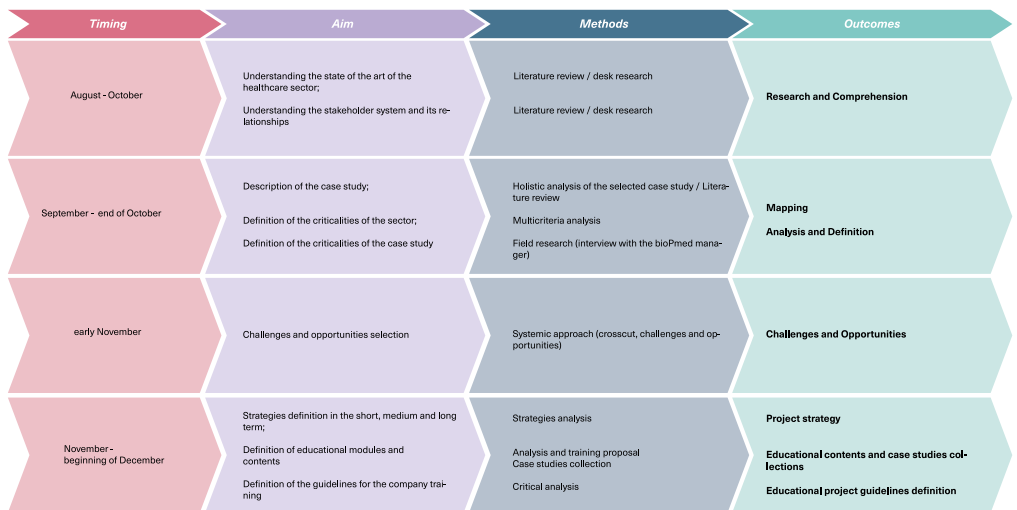
Methodology

In general, the steps of the systemic approach are:

- Holistic Diagnosis of the context;
- Holistic Diagnosis of the specific actor: a company or a case study;
- Analysis of the criticalities, both of context and the specific actor;
- Challenges & Opportunities;
- Definition of the strategies that can be adopted;
- Systemic project;
- Project Outcomes, including spatial scale, time frame and phases of the project implementation, advantages and benefits provided by the project (Barbero & Pallaro, 2017).

Roadmap Definition

A roadmap allows the organisation over time of systemic methodology steps.



In general, the individual aims were scheduled in order to organise research and development as well as possible. It may be noted that the phase with the longest duration was the healthcare sector preliminary analysis, as it was essential to know scope and structure of the field of analysis, as it is a huge and articulated topic.

Definition of Literature Review

The literature review was carried out, first of all, to understand the context of reference -since the health sector was a new field for the research team- secondly to define critical issues in the health framework, useful for the project development.

The creation of a logical structure for the literature review was indispensable in order to give a reading key to the contents and to choose the level of detail with which to analyse them.

Fig. 1
Martina Motta, Enrica Ferrero, Giulia Ferrero, Elisa Ghignone.
Systemic design applied to Medtech, Master Degree in "Systemic Design" at the Politecnico di Torino, 2021.
Roadmap used to organise activities and timing of the research and the project itself.

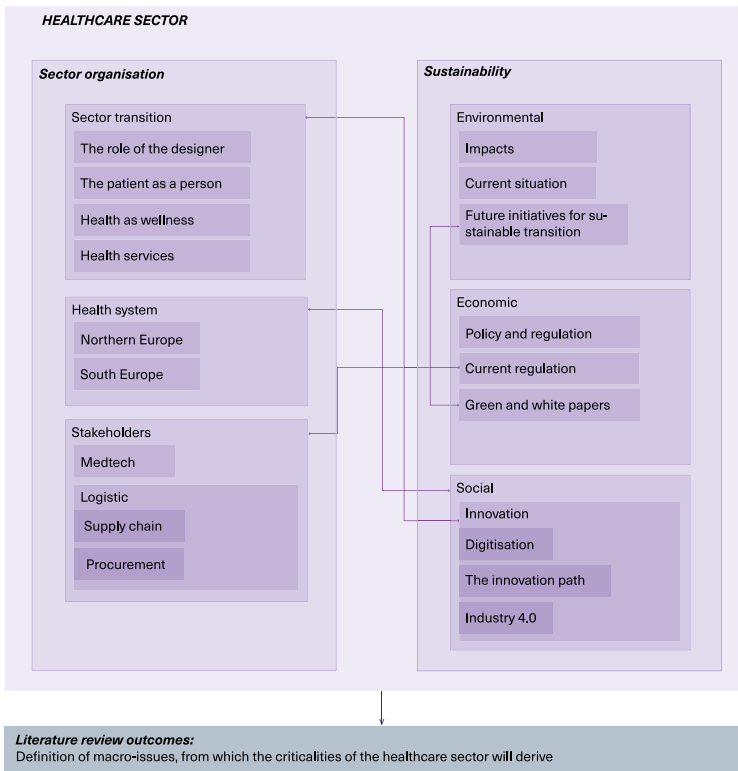


Fig. 2
Martina Motta, Enrica Ferrero, Giulia Ferrero, Elisa Ghignone. *Systemic design applied to Medtech*, Master Degree in “Systemic Design” at the Politecnico di Torino, 2021. Literature review structure.

Specifically, it focused on two specific themes:

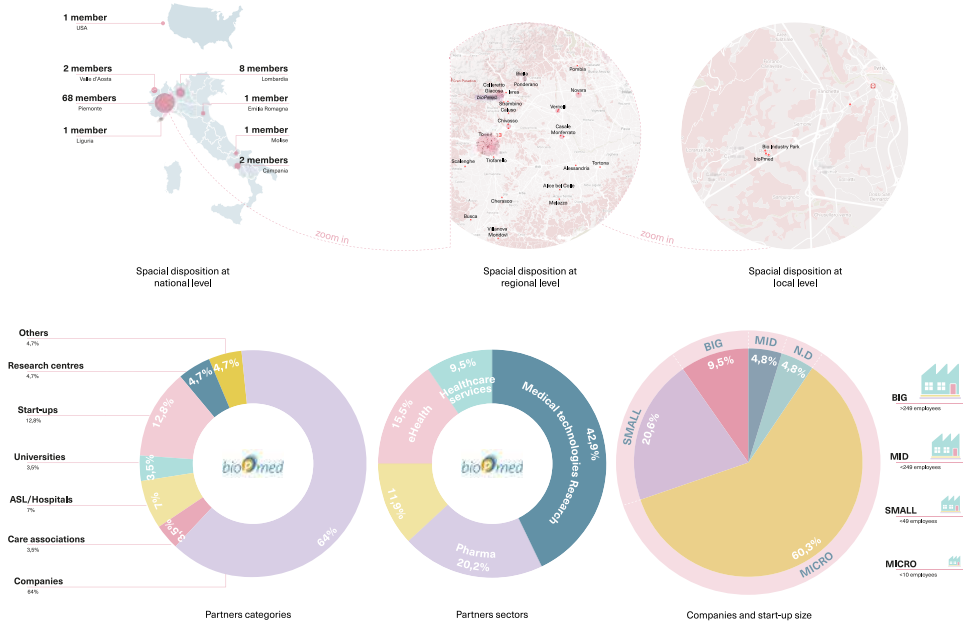
- A Organisation: the healthcare system is in transition, there are differences between European countries, relationships with various stakeholders and productive sectors, especially public ones.
- B Sustainability: the healthcare sector is investigated through its impacts, current situation, and future initiatives; economic sustainability with current regulations and possible future developments; social sustainability with innovation aspects.

Case Study Selection: The Biopmed Cluster

As the healthcare sector is very complex, to define a “reference user” allows a Sustainable Healthcare project to be developed with a clear objective and a precise scale. The bioPmed Innovation Cluster has been selected to develop a sustainable training project that is subsequently scalable and usable by other European players. The choice of this case study was guided by its importance on territory and by the innovation it embodies, at the moment not directed towards sustainability. Cluster presents a territorial network, also aimed at the European sphere, thanks also to projects realised together with other European regional clusters.

An in-depth analysis of the cluster permitted to understand the dynamics and potential of the actor in becoming a local refer-

ence point for training on sustainability, as well as the strong presence of SMEs, which are consequently the project's audience.



Challenges, Opportunities and Strategies

Criticalities emerged from the health sector were related to the smaller and specific bioPmed scale. Cluster itself is characterised by peculiar criticalities, but these are directly influenced by the sector itself.

Sector and case study analysis revealed several shared criticalities and opportunities.

In particular, the main criticalities are the lack of:

- Awareness and training regarding sustainability of the healthcare sector,
 - Green policies to incentive sustainable transition through regulation,
 - Inter-company collaboration,
 - Upstream sustainable design by the MedTech companies.
- Instead, the main shared opportunities are:
- Using bioPmed cluster as a focal point of the training course and as case study for other entities,
 - Initiating a bottom-up process to encourage the whole sector to consider the positive role of sustainability,
 - Allowing the collaboration between companies,
 - Training MedTech companies on the sustainable design and its potential.

Fig. 3
Martina Motta, Enrica Ferrero, Giulia Ferrero, Elisa Ghignone.
Systemic design applied to Medtech, Master Degree in “Systemic Design” at the Politecnico di Torino, 2021.
Analysis of cluster members typologies and their spatial disposition.

Research outcomes

Strategies Over Time

The four emerged strategies were timed according to their level of complexity. Short-term strategies are the starting point for implementing the subsequent ones over time.

The systemic design, and consequently the training course that will be developed also thanks to this research, has more power of action on some issues. Consequently, the temporisation of the strategies, visible in Figure 4, has allowed the inclusion of medium and long-term activities which are currently far from the direct sphere of action of the project, but which will become possible after the first short-term strategies have been achieved. In detail, the short term focuses on two consequential steps.

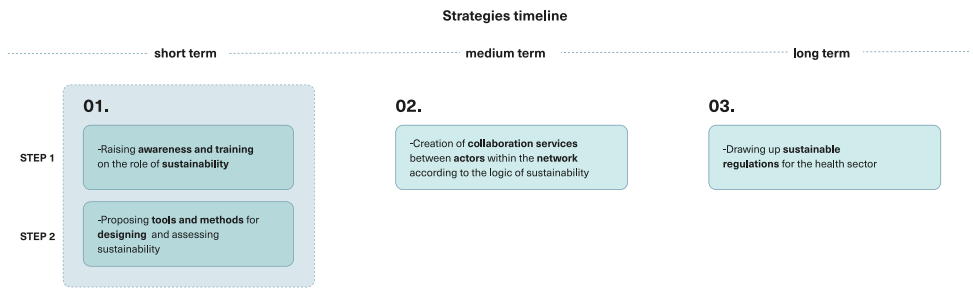
The first one concerns raising awareness and training the companies about the role of sustainability in the health sector, specifically in the MedTech.

The second step is proposing tools and methods that companies can use to design sustainably and measure the impacts of their products. Thereby, this step aims to help SMEs (small-medium enterprises) from a practical point of view. In particular, by supporting them in choosing strategies and methodologies suitable for their objective and in mastering tools and indicators useful to measure initial impacts and future improvements, but also to quantify the benefits achieved with Sustainable Healthcare logics.

In the medium term, it is possible to use the outcome generated by the short-term steps for the creation of a collaboration service between actors, proposed by bioPmed, and creating networks according to circular logic. In this network, companies can find new partners for sustainable virtuous projects and create circular collaborations for the use and transfer of by-products and waste as resources for other production processes.

In the long-term, the network will achieve the become a reference point for MedTech sustainable healthcare in the territory. This empowerment may allow collaboration between the actors of the network, and bioPmed, with NGOs or territorial bodies, in order to draw up new green regulations in the sector, which are currently practically missing. This regulation should be based on the direct point of view of the local MedTech companies, their providers, the bioPmed cluster perspective and other crucial players.

This timeline allows to scale up the project starting a process in order to fill the gap of sustainable healthcare regulations at regional, Italian and European level.



Training Content and Guidelines

The final research objective is the definition of training contents for companies operating in the medical sector, aiming to encourage them to embrace the ongoing sustainable transition.

Contents were organised in four separate modules with different objectives and outcomes.

- 1 Fundamentals gathers all the information necessary to introduce the actors to the salient issues in the relationship between Healthcare and Sustainability;
- 2 Designing for Sustainable Healthcare aims to focus the training on the role of design by making companies aware of the design possibilities and achievable results and benefits;
- 3 Co-design as a strategic approach aims to raise consciousness of the role of collaboration between different realities in order to create valuable projects;
- 4 Monitoring and measuring sustainability provides an additional level of insight by offering companies measurable methods to quantify impacts and achievable outcomes.

The modules are designed to lend themselves to different levels of in- depth study of sustainability in the healthcare sector. In particular, three training courses have been planned, divided according to the scope of the contents proposed. The first course, called Basic, brings together the first module and aims to train on the basics of Sustainable Healthcare. The Intermediate course, on the other hand, includes the basic “Fundamentals” module plus “Design for Sustainable Healthcare” and “Co-design as a strategic approach”. It is designed for companies interested in putting sustainability into practice in their design choices. Finally, the Advanced course also includes the module ‘Sustainability. Monitoring and Measurement’ in order to support design choices with defined measurement methods allowing companies to use these tools to make business forecasts.

Specifically, the training contents have been organised in a matrix scheme designed to best meet the context needs. The modules, previously described, are self-consistent, with well-defined training objectives and outcomes. On the other hand, the transversal themes are arranged horizontally, as they are topics that it is important to analyse in all four vertical modules. They create continuity in the training path and define which corporate training methods and types of language are best suited to train based on the type of content.

Fig. 4
Martina Motta, Enrica Ferrero, Giulia Ferrero, Elisa Ghignone.
Systemic design applied to Medtech, Master Degree in “Systemic Design” at the Politecnico di Torino, 2021.
Short, medium and long-term project development.














Fig. 5
Martina Motta, Enrica Ferrero, Giulia Ferrero, Elisa Ghignone.
Systemic design applied to Medtech, Master Degree in “Systemic Design” at the Politecnico di Torino, 2021.
The four modules of the training course.

Transversal themes in detail are:

- A Awareness on the role of sustainability;
- B Optimization of materials, resources and wastes;
- C Sustainable products and services;
- D Corporate Responsibility.

Matrix structure makes it possible to define coherent contents in the course, organised according to the level of detail and with increasing complexity. Specifically, the complete path allows the passage from Awareness to Corporate Responsibility, that is the practical realisation of sustainability by companies, which recognise their own role in the system and the actions they can carry out to contribute to the goal.

	1 Fundamentals	2 Design for sustainable healthcare	3 Co-design as a strategic approach	4 Sustainability monitoring and measurement	Modalities	Languages
A Awareness	Sustainability in the healthcare sector <ul style="list-style-type: none"> Sustainable Healthcare Sustainable transition viable by the sector Phases of the life cycle of the medtech product 	The role of sustainable design in healthcare <ul style="list-style-type: none"> Design as a driver for innovation White papers and green papers NGO initiatives 	The importance of co-design <ul style="list-style-type: none"> Collaborative network concept Concepts of system of actors Systemic vision 	Monitoring as a planning tool <ul style="list-style-type: none"> Impact prediction and prevention Sustainability as a competitive advantage Measurement of current and future benefits 	 Contents in pills	 informative
B Optimization	Resources and waste <ul style="list-style-type: none"> Impacts of the sector Management and disposal Waste prevention Benefits of optimization 	Logistics and Transportation <ul style="list-style-type: none"> Logistics (Tools for assessing the life cycle, LCA, Green Supply Chain) Packaging (materials and transport) 	Integrated strategies <ul style="list-style-type: none"> Industry 4.0 Key Enabling Technologies Strategies for sharing plants and production processes 	Consumption management <ul style="list-style-type: none"> Monitoring tools (Carbon footprint, OEE, LCA) Consumption efficiency (energy, transport, materials, buildings) 	 Online content, insights, tools, ...  Online webinar	 technical
C Products and services	Materials and sustainability <ul style="list-style-type: none"> Study of materials Impact of traditional materials Life cycle Disposable concept 	Sustainable strategies <ul style="list-style-type: none"> Circular economy strategies (Reconditioning, Reuse, Maintenance) End of life design (for disassembly, for components) 	Multi-disciplinary <ul style="list-style-type: none"> Collaborative design Activity theory 	Sustainable indicators <ul style="list-style-type: none"> Social sustainability indicators Environmental sustainability indicators Economic sustainability indicators 	 Contents in pills  Practical exercises, case studies to identify oneself; team work	 practical
D Corporate responsibility	The role of businesses <ul style="list-style-type: none"> The responsibilities of the company High-Value Care 	Certifications <ul style="list-style-type: none"> Medtech sector product classifications European and Italian legislation 	Shared corporate responsibility <ul style="list-style-type: none"> Responsibility in the local context The role of collaboration between companies Methods of collaboration between companies 	Procurement as a recognition of value <ul style="list-style-type: none"> How to measure corporate responsibility Green Procurement Strategic procurement Value based-procurement 	 Quizzes, questions, games, scores, teams  Online workshop and hackathon	 playful and engaging

Based on these contents, specific training methods and languages can be used in the various themes, as shown in Fig. 6.

In the case of “Awareness”, the use of contents in pills proposed through an informative language is appropriate, this allows the transmission of basic concepts without weighing down the communication and to prepare the user for more in-depth topics.

“Optimisation” can be covered with dedicated online webinars supported by content, insights and on-demand tools available to the business. The technical language allows to use vocabulary related to the specific topic and to tell the content in detail.

On the other hand, “Products and Services” is suited to a more practical language accompanied by contents in pills and the use of practical exercises, case studies and group work to show the practical usefulness of the topics and the modalities of their implementation.

Finally, “Corporate Responsibility” can become a moment to collect conclusions on previous training, technical and practical contents by showing them from the perspective of the company’s role. Playful and engaging language allow to re-engage attention. While the use of engaging and innovative training methods can help companies to test their knowledge with quizzes and games and to apply new skills with workshops and group hackathons.

A key aspect of education on this content is the use of some case studies to help companies understand the concepts proposed by showing them practical examples and the benefits obtained.

Fig. 6
Martina Motta, Enrica Ferrero, Giulia Ferrero, Elisa Ghignone.
Systemic design applied to Medtech, Master Degree in “Systemic Design” at the Politecnico di Torino, 2021.
The training content matrix with tools and methods.

At the end, some guidelines for future development are listed. The guidelines are intended to give further insights into the development of the actual training course.

They have been grouped into four key themes: Tone of voice, Training Modalities, Content and Involvement, organised into various levels according to the degree of detail.

The “Tone of voice” gathers ideas about language and communication choices, which have to be adapted to different users. The “Training Modalities” guide the creation of a training path based on different levels of depth, the use of activities to involve companies. They aim to create a gradual pathway to ecoliteracy. The “Content” emphasises the importance of creating a narrative across the training modules and proposes some important communication topics for companies: business update, practical utility shown with case studies, competitive advantage and innovation achievable by embracing sustainability. Finally, “Involvement” defines the need to include different experts for multi-disciplinary training. The training course aims to create a “network” culture and team building moments between different companies.

Future Developments

The research can be considered as an extension of the literature review on the topics of healthcare and sustainability of the sector, in particular with reference to the European context.

Moreover, it represents a theoretical-practical basis for the development of the training course that will be developed in the European project Systema, as it collects all the concepts of the healthcare sector useful to the project study and related to the internal logic of the system. It therefore proposes a package of contents and guidelines that can be used in practice to develop the training programme, dedicated to MedTech SMEs (companies producing medical products, devices and equipment).

Sustainable Healthcare is an ongoing transition, which is lagging behind other sectors and needs to be achieved quickly. On the positive side, there are possible modalities and actions to be taken to implement the transition, some of which are already being practised by other sectors. In this sense, training plays a decisive role, especially in creating awareness among companies of the role they can play in the transition, as well as the “cards” they can play in the process. The real challenge for the designer is the choice of methods and tools to teach with and to train companies, particularly taking into account the characteristics of the enterprises. In fact, the size of the company and its attitude and perception of the topic can drastically influence its point of view on sustainability, as well as its initial interest in undertaking the training.

In conclusion, the role of the designer is to educate on the topic of Sustainable Healthcare by teaching companies how to best use the new “cards” they own to win the challenge against today’s unsustainable healthcare.

So all that remains is to play.

Enrica Ferrero

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Reducing Waste in Healthcare: A Systemic Design Approach for Sustainable Disposables Manufacturers

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Abstract

Efficient waste management is crucial in the healthcare system due to the complex composition and associated risks to workers, patients, and the environment. While there is growing awareness of the need to change the system, there is still an urgent need for a sustainable healthcare system. Sustainability concepts can guide designers in taking action, from considering waste reduction in the choice of materials to optimizing management systems through information and staff training. Systemic design methods can help involve business teams in the development of sustainable practices and strategies for production, use, and disposal. Research aimed to identify the types of disposables produced according to their polymers and weight, and to detect associated problems. The quantification of results led to the development of strategies aimed at reducing the number of polymer types used in product manufacturing with a case study on the Neonatal Nasal Mask, a consumable device was conducted to apply sustainable design strategies.

Keywords

Healthcare LCA
Disposables
Neonatology
Circular product design
Circular economy

Introduction

Over the past decade, the global problem related to environmental pollution emerged as one of the most debated issues in multiple sectors and on what strategies might be necessary for a redirection of the globe toward a future that seems compromised. In 2017, global healthcare expenditure was estimated at \$7.8 trillion worldwide and is about 10% of the world's gross domestic product (GDP) (WHO, 2019). In healthcare facilities, waste management plays a primary role because of the complex and diverse composition of the waste produced, the potential risks their handling poses to health, the safety of healthcare operators, patients, environment, and the costs of their disposal. For this reason, the study explored the lifecycle of medical consumables for Neonatology departments in a purely corporate context, in which to observe, project, and test new sustainable solutions in the entire product lifecycle, not until they are delivered to the healthcare facility, but to their separation and proper disposal in the hospital area. Specifically, the following research questions that guided the study:

- Which raw materials are used in the production of the company's single-use medical devices, and which of these could be replaced with sustainable alternatives?
- Which of these products are composed of two or more types of polymers?
- Which of them can be redesigned by reducing the typology of multi-material products and the assembly parts of them?
- Which items have the highest and lowest overall weight among the product range, and what percentage does packaging affect the overall weight of the company's disposables?

Background and Problem Identification

From an overall perspective, pollution is a major cause of morbidity and mortality in the world and was associated with about 9 million premature deaths globally in 2015, accounting for 16% of all deaths (Landrigan, 2018). Environmental pollution produced by the Global Health system has been a serious problem to be focused on since as far back as 1995. On that date, the U.S. Environmental Protection Agency identified medical waste incineration as the main source of dioxin production, one of the most potent naturally occurring toxic and carcinogenic chemical compounds. (Thornton et al., 1996). Studies in the United Kingdom showed that 80 percent of the National Health Service (NHS) generates 22.8 million tons of carbon dioxide emissions annually, with 60 percent consisting of equipment and consumables (Centre for Sustainable Healthcare, 2017).

During the pandemic period, growing concern about the risk of infection contributed to increasing amounts of disposable items and their packaging disposed of as clinical waste. Almost all this waste was incinerated, even though some of it could potentially have been recycled. (Silva et al, 2020). A study led by Benson et al., shows that 1.6 million tons of plastic waste generated daily worldwide, also estimating the disposal of about 3.4 billion disposable face masks or

face shields being discarded daily. (Benson, 2021). By placing attention on the types of polymeric medical products, the European Commission recognized plastics as a key priority for a paradigm shift, in which consumers should be “aware of the need to avoid waste and make the right choices” (Foschi & Bonoli, 2019, p.18). Numerous challenges are currently being pursued by hospitals and nongovernmental organizations aimed at making the healthcare sector sustainable, but these fail to counterbalance the incompatibility generated in the massive daily use of medical disposables and packaging with the strict environmental need to reduce and minimize the impact these products have on the environment from their production to their disposal.

Literature Review

One of the terms that the research pathway focuses on, closely related to the principles of sustainable design, is the concept of circular economy, one of the most recognized definitions of which is offered by the Ellen MacArthur Foundation, which a circular economy is one that is reparative and regenerative by design and aims to maintain products, components, and materials at their maximum utility and value at all times, distinguishing between technical and biological cycles (Ellen MacArthur Foundation, 2015). Another significant definition that meets the research aims refers to the EU Action Plan for the Circular Economy: “In a circular economy, the value of products and materials is maintained as long as possible; waste and resource use are minimized and resources are kept within the economy when a product has reached the end of its life, to be used again and again to create further value” (European Commission, 2015). Over the past two decades, many communities around the world began to recognize the need of a transformation in healthcare, but despite the growing attention to the urgent need for a sustainable health care system, there still appears to be little sustainable research and actions that can be implemented in Neonatology areas, an area where the use of single-use products has a major impact on costs and the environment (Newman, 2011; Nichols 2014). The reasons behind the problem can be found in the pilot study by Verma et al., in which they state that “neonatal care is an acute case specialty, and causally due to the high rate of admissions with neonatal sepsis and other forms of infections, to maintain sterility the current practice, it is standard to discard or in sterilizing all unused items present at the bedside of infants who have tested positive or suspected of having an infection”, generating an additional cost to patient care. In addition, excess supplies are assumed to be infected if infant tests positive for infection, and all unused supplies are discarded, when infant is discharged or dies (Verma et al., 2019). Studies conducted by the Royal College Nursing (2011) provided some clues about the high cost and differences between the costs of “clinical” or “infectious” waste and household waste, seeing that per ton, the management of “infectious” clinical waste costs about three times that of household waste (RCN, 2011). A proper waste separation, as stated by Nichols (2014), lead to the compromise of neonatal wards and can reduce the ability of staff to effectively separate waste at the point

of generation. The goal of properly separating waste at the point of generation prevents non-infectious waste from being disposed of through the more costly clinical waste stream, thereby increasing costs that can be up to three times higher than ne-needed (Nichols et al., 2016). In conclusion, literature suggests that healthcare organizations have not yet adopted the concepts of sustainable development and circular economy such as, for example, systems for tracking, monitoring, and assuming sustainable waste management practices aimed at waste reduction, reuse, and recycling. In this regard, research pushes for the implementation, in the manufacturing context, of methodologies and design concepts inclined to a multi-directional sustainability found both in the production area and in use and disposal.

The Sustainable Design Value

To understand in what different ways they connect with and affect design, it is necessary to make a distinction between the definitions of Green, Sustainable and Regenerative, when they are referred to the sphere of circular design, seemingly similar in their meaning but different in their design operation. Regarding Green Design, as stated by Raymond J. Cole, it aims to reduce the negative and harmful impacts on both the environment and humans resulting from the development of the latter in the process of humanity's evolutionary growth (Cole, 2012). The variance of regenerative design from concepts of sustainability is emerged in the purpose to reconnect humans with nature through a renewal of a set of ecological and social systems. Unlike its precursors, the regenerative approach stimulates continuous feedback at each stage of its process by generating results that are adaptable and dynamic to the operational context. Only in past few years there has been a shift toward a circular approach to resource consumption, increasing interest in circular actions that can be implemented even in health care settings, finding in such circumstances, in the figure of the designer, the expertise useful for the implementation of the concepts previously outlined in a specific context, a potential actor for a transformation to a circular economy. The designer capabilities within the English health system, as Freire and Sangiorgi (2010) state, in their analysis of the evolution of the sector from care to cure has been directly shifting from a mere design of products to a role as a facilitator of connections between stakeholders and simultaneously as a provider of tools, methodologies, and strategies to assess and solve the current problems of the complex health system (Freire and Sangiorgi, 2010).

Limits of Research Field

The research aims to reconcile the health needs of citizens with environmental health compromised by consumables in the health-care sector. The scientific problem involves different healthcare departments, but focusing holistically on the problem would result in large structural and organizational complexity. Therefore, the survey focuses on the Neonatology department, which is likely to

use disposable items daily for care, considering important evidence demonstrated by international research, which show a high use of disposable devices to minimize the risk of infection on patients (Settimo & Viviano, 2013). This ultra-specialization of pediatrics deals with the medical treatment of newborns, and in Italy, the care is provided in three levels based on the number of annual deliveries and neonatology ward characteristics. The choice of investigating this department is due to its high use of disposable devices to minimize the risk of infection on patients and collaboration with GINEVRI, a company engaged in producing medical equipment and disposable products for neonatology wards.

The reasons related to the choice of investigating this type of ward are summarized in two main reasons.

- The collaboration in the research path with the company GINEVRI, which has been engaged in the design and production of medical equipment and disposable medical products for neonatology wards, with which it is possible to have a field screening of the types of disposable items produced in order to map their product life cycle from their CAD design, to packaging and labeling for consecutive sale to public hospitals as well as private facilities.
- Evidence obtained from the scientific literature, which affirms a lack of focus on the quantities of waste produced in this department on procurement costs and the high cost of management of waste produced in the Neonatology area.

Methodology and Research Phases

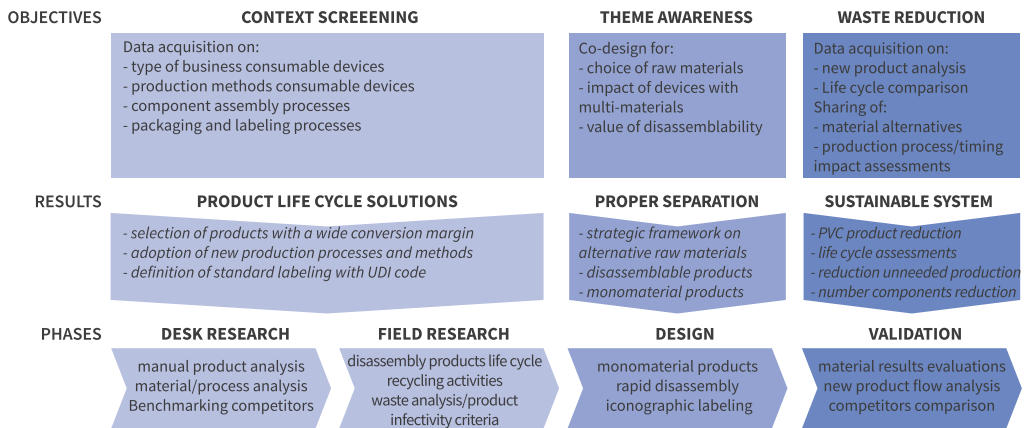
The research adopted the Systemic Design method, combined with principles of Sustainable and Anthropocentric Design, to involve the business team in practices and strategies for the production, use, and disposal of disposable polymer products. Participatory design tools allowed co-design with stakeholders involved in the life cycle of plastic products within specialized companies and Neonatology wards in Lazio. The research stages Fig. 1 carried out to achieve the subsequent results followed the following breakdown:

Desk Research

- Acquisition of paper and digital material of technical data and user manuals of consumable goods produced by the company GINEVRI, for a preliminary enquiry of the production processes and raw materials adopted for each product.

Field research

- Acquisition of data from administrative staff, through the company's management program, of the quantities and types of periodic purchases made by the regional operators regarding the purchase of consumable goods for Neonatology
- Observation of medical dispositive assembly practices and their packaging in single or kit mode
- Production of photographic documentation and numerical quantification of data related to the company's consumable goods and the types of primary and secondary packaging adopted for transportation.



Results

Fig. 1
Research methodology and stages (Gabriele Maria Cito, 2022).

The results from the two types of research analysis allowed for the gaining of data collection that was crucial for the construction of the design phase. Among the data collected in the desk phase of the research were:

- Types of consumable devices produced by company
- Production process of disposable medical devices
- Assembly processes of product components
- Primary and secondary packaging processes
- Design methods of labeling disposable devices

Pilot desk research carried out in the company area made it possible to return a mapping of the items in the company to keep track of the quantities of material entering and leaving the company, as well as the type of packaging of each consumable device.

The field research, on the other hand, carried out a photographic documentation activity of the consumable goods produced in the company and the types of primary and secondary packaging for transport, through a selection and photographic documentation of the single-use items produced and assembled in the company in order to get an overview of the macro-areas of use and the choice of packaging adopted for each consumable device. Fig. 2

The following parameters were considered in the field analysis:

- Name, material, available in multiples, weight of the consumable item
 - Material, weight of packaging items
 - Percentage of weight packaging based on total weight.
- Among the data acquired in the field phase of the research, the following can be found instead:
- The two-way disposable circuit is a heavy item composed of multiple polymer components that do not come into direct contact with the patient and can potentially be recycled according to specific polymer streams.
 - 35.7% of the range of disposable items considered in the survey are composed of multi-material.
 - 42.8% of the products analyzed are composed of PVC, which is one of the most polluting polymers for production pro-

cesses as well as recycling activities.

- The packaging for disposable items is mostly composed of LDPE, which is among the least polluting materials for both production and recycling.

This pathway enabled an expansion and sharing of knowledge about the disposables produced in the company, generating the following results:

- analytical assessment of primary and secondary packaging processes and a tracking of the types and quantities of materials produced by the company
- identification of critical issues related to packaging weight for certain items
- general assessment of the major types of products purchased by sanitary facilities regarding neonatal care.



Conclusions and Future Developments

In this research, an analysis of the company's production processes regarding consumables for Neonatology departments was carried out. This research stemmed from the need to have an overview of the types of materials produced according to their polymer composition, their specific weight, and the best assembly and labeling processes for disposable items.

The activities carried out for the survey were:

- the observation of the company's user manuals of each company's medical device from which resulted in the identification of the types of raw materials used
- photographic documentation that allowed the cataloging of weights for corporate products and packaging, and finally an analysis of the packaging processes and
- amount of information in labeling that led to the definition of an adaptability of both the size of the packaging used and the size and information illustrated on the labels

Fig. 2
Photographic documentation on polymer material typology and packaging manufacturing methods by Ginevri Srl. (Angela Giambattista, 2022).

The methodology used to carry out the survey of such desk products, through the acquisition of company information material acquired and reprocessed in the form of an Excel sheet showing an overview of what is the current state of the company's disposable products and what are the peculiar critical issues that can be acted upon. Tab. 1. Then, field research was conducted to quantify in person, through observation and weighing of products and packaging useful for understanding the major polymers used in the range of corporate disposable devices.

Product Name	Weight item	Weight pack	Weight overall	% pack per product	Material Item	Material pack	Product Name	Weight item	Weight pack	Weight overall	% pack per product	Material Item	Material pack
Smart Flow Kit Niv Multisize	67	16	100	16,0%	MIX	LDPE	Flow Cannula - XXS	16	8	24	33,33%	PVC	LDPE
Smart Flow Kit Niv Extra Small "Rosso"	69	12	107	11,2%	MIX	LDPE	Flow Cannula - XS	16	8	24	33,33%	PVC	LDPE
Smart Flow Kit Niv Small "Verde"	70	12	109	11,0%	MIX	LDPE	Flow Cannula - S	16	8	24	33,33%	PVC	LDPE
Smart Flow Kit Niv Medium "Bianco"	70	12	110	10,9%	MIX	LDPE	Flow Cannula - M	17	8	25	32%	PVC	LDPE
Smart Flow Kit Niv Large "Blu"	70	12	111	10,8%	MIX	LDPE	Flow Cannula - L	17	8	25	32%	PVC	LDPE
Circuito Paz. T-piece C/valvola Peep	41	10	51	19,6%	PVC	LDPE	Cover di Protezione Materassini	15	12	27	44,44%	PP	LDPE
Tubo Doppio con trappole PNT	53	10	68	14,70%	ND	LDPE	Nasal Cannula Ø2-L8 Mm	2	2	4	50%	TPU	LDPE
Mascherina Facciale Size1	12	3	15	20%	PVC	LDPE	Nasal Cannula Ø2-L10 Mm	2	2	4	50%	TPU	LDPE
Mascherina Facciale Size2	16	3	19	15,78%	PVC	LDPE	Nasal Cannula Ø3-L12 Mm	3	2	5	40%	TPU	LDPE
Sync Flow Cannula - XXS	71	6	77	7,79%	PVC	LDPE	Nasal Cannula Ø3-L14 Mm	4	2	6	33,33%	TPU	LDPE
Sync Flow Cannula - XS	72	6	78	7,69%	PVC	LDPE	Circ.Disp.Risc. 2 Vie + Camera Umid	343	53	381	13,91%	MIX	LDPE
Sync Flow Cannula - S	73	6	79	7,59%	PVC	LDPE	Test Lung Ventilazione Non Invasiva	33	3	36	8,33%	VMQ	LDPE
Sync Flow Cannula - M	73	6	79	7,59%	PVC	LDPE	Adattatori per circ. Wetty	7	1	8	12,50%	ND	LDPE
Filtro Aria Inc. Polytrend	19	11	41	26,82%	ND / TEX	LDPE	Filtro antibatterico per circuito paziente Giulia	22	3	25	12%	ND	LDPE

The manufacturing company can gain greater knowledge about disposable products by analyzing data on their material composition and assembly. By identifying the percentage of multi-material types and PVC items, specific actions can be taken to address these issues. This research can also lead to the formulation of mono-material products with less impactful polymers, both in their production and recycling. New prototypes of disposable products that reduce environmental impact through circular design have been developed based on field research. Communication with users through new manuals and labeling will inform them about the types of polymers used, increasing potential for proper recycling.

The following are the strategies that the company has begun to implement following the conducted analysis, with which it can redesign the life cycle of consumables and their environmental impact in the production process. In sustainable design, the choice of materials is crucial to reduce the environmental impact of products. In this context, we have analyzed the differences between two materials commonly used in neonatal nasal masks: TPU and PVC.

Tab. 1
Multipolymers & PVC recycling difficulties, LDPE packaging for all the items and the percentage between packaging and overall pack weight showed critical issues such as products weighing just twice as much as the packaging containing them (Gabriele Maria Cito, 2022).

In the following table, we summarize the characteristics of these two materials, including the origin of raw materials, biodegradability, recyclability, and the environmental costs of production, recycling, and disposal. **Tab. II**

SYSTEMIC IMPACT ASSESSMENT

- POSITIVE VALUE
- NEGATIVE VALUE

Characteristics	PU	PVC
Flexibility	5 Shore A7	0 Shore A
Break resistance	0 MPa	40 MPa
Compatibility with human body	Approved for medical use	Approved for medical use
Biodegradability	Non-biodegradable	Non-biodegradable
Emission of toxic substances	Low VOC emissions	High VOC emissions
Recyclability	Recyclable with low costs	Difficult to recycle
Origin of raw materials	Derived from petroleum products	Derived from petroleum products
Environmental cost for raw material origin	High	High
Production cost	Medium-low	Medium-high
Recycling cost	Low	Medium-high
Disposal cost	Low	Medium-high
Availability of raw materials	Wide availability	Limited availability
Environmental impact during production	Low	High
Environmental impact during disposal	Low	High

Tab. II
Main differences between TPU and PVC materials used in the lifecycle process of neonatal nasal masks. (Gabriele Maria Cito, 2022).

The project resulting from the life cycle analysis carried out in the company in correlation with the company's operational needs was the design and prototyping of a nasal mask for the Oxygen Therapy procedure performed with equipment for neonatal ventilation. The following are the strategies and applications in the company's area for the specific case study:

**Adoption of monomaterials
and less environmentally impacting materials**

This approach is manifested in the design of a Nasal Mask that meets the need to be adaptable, through a modular joint, to various configurations of support for neonatal breathing. Regarding the material choice, the company directed itself towards producing the designed component in Silicone TPU instead of PVC, as it offers greater flexibility and softness compared to PVC, making it more comfortable to wear and reducing the risk of skin irritation. Additionally, Silicone TPU is less prone to cracking and breaking than PVC, which means it can last longer and require fewer replacements.

Design of devices with easy disassembly of components

Through a redesign of the Nasal Mask product, in relation to the disposable articles with which it is used in operational settings, the number of components necessary for mask adaptability has been reduced from n° 3 to 2. This simplifies the disposal process by making it easier to disassemble and not using multiple materials for the components for healthcare workers.

Use of circular design integrated into the product design phase

The mask design includes the adoption of a modular joint that allows the mask to be adapted to various configurations of support for neonatal breathing. This circular design approach creates a versatile product that can be used for different needs and in different contexts, reducing the need to produce and dispose of specific devices for each individual use. Additionally, the circular design of the mask reduces the number of components necessary for adaptability, simplifying the disposal process and reducing the use of multiple materials for the components.

Selection of products with potential for sustainable conversion

Considering disposal impacts, both PVC and Silicone TPU are materials that can be recycled, but with different difficulties and costs. PVC is known to be difficult to recycle and often requires the use of special disposal processes. Silicone TPU, on the other hand, is a relatively new material and is still developing efficient recycling techniques. However, Silicone TPU offers greater chemical resistance than PVC, which means it can be disposed of more safely without releasing toxic substances into the environment.

Adoption of new production processes and methods

In the previously mentioned project, alternative production methods to PVC for some disposable articles for neonatology allow for a reduction in production impacts because:

- Silicone TPU is less prone to thermal deformations than PVC, which means it can be processed at higher temperatures without damage.
- Silicone TPU is less likely to adhere to working surfaces than PVC, which means it can be processed with fewer release agents and solvents.

Labeling with instructions for correct disposal

The labeling of the mask includes information on the material used for production and instructions for the correct disposal of the product. In this way, healthcare workers can correctly dispose of the mask and reduce the negative environmental impact associated with

the production and disposal of disposable medical devices. Proper labeling can also help ensure that the mask's materials are correctly separated for recycling or appropriate disposal.

While sustainable production can be challenging due to increased costs and difficulty sourcing sustainable materials, companies can benefit from increased efficiency, better resource management, and improved customer loyalty. GINEVRI has implemented strategies such as using less impactful materials, designing disassemblable devices, and adopting circular design to reduce the environmental impact of its products and promote a circular economy. These practices could lead to increased efficiency and cost reduction while improving the company's reputation in sustainability.

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A Framework to Design Appliances for the Circular Economy Scenario

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Abstract

Should the appliances change to adapt to new conditions in the current scenario of a compromised environmental situation? The human needs to cook food, wash dishes and do laundry are the same, but society and our relationship with mother nature have changed radically. Although many contributions to the design for sustainability, the changes in the design sector and the market are not always visible.

This paper is part of a research project on the design of appliances for the circular economy scenario and intends to understand *Is there the need to re-design the current one, design new ones, or invent something else? How to decide? Are we considering all the aspects?* The problem was tackled using a systemic design approach.

The result is a framework that contains the data collected by the research steps, maps all the implications that the design of appliances in the circular economy scenario should consider in the process, and visualises the complexity of the topic.

Keywords

Appliance

Circular economy

Systemic design

Ecodesign

Framework

Introduction

As experts are claiming, we need to invert the road of the current way of producing and consuming soon, otherwise 2050 will be the year of non-return with +1,5° (IPCC, 2018) due to the compromised environmental situation. In this scenario, can the appliances be similar to the one in the 1950s when they came up in the market? The human needs to cook food, wash dishes and do laundry are the same, but society and our relationship with mother nature have changed radically. Sustainability has become one of the primary goals of our actions (UN, n.d.) and the design discipline was not blind concerning this situation, embracing its ethical responsibilities as demonstrated by various movements as the *Design for sustainability* in the review by Ceschin and Gaziulusoy (2016), taking for example the publication by Vezzoli and Manzini (2007) and Bistagnino (2008; 2011) in the Italian context. Berwald et al. (2021) in their research delineated guidelines to design circularity for the Electrical and Electronic Equipment (EEE) sector and cited other strategies in the *Design for the environment* as *Design for Multiple Life Cycles*, *Design for Disassembly and Reassembly*, *Design for Remanufacturing*, *Design for Recycling*, *Design for End-of-Life*, etc. They referred to the review by Sassanelli et al. (2020) about the *Design for X* strategies. Considering these works, the indication of guidelines seems to be the most common method to indicate the road to follow in the design process. Although these many publications, the changes in the market are not yet always visible. However, it should be no more a personal inclination by just a few scholars, but it is becoming a requirement. The European Union has clearly stated the mission for the year 2050 with the European Green Deal (EC, 2021): being climate-neutral with an economy with net-zero greenhouse gas emissions. One of its building blocks is that the economy needs to shift from a linear to a Circular Economy (CE) (EC, 2020). In 2022 for example the European Commission reviewed and published in March the Working Plan 2022–2024 about Ecodesign and Energy Labelling (EC, 2022), thinking of including also some professional appliances. Moreover many scholars focused on the definition of circular business models as the review by Lüdeke-Freun (2019).

This research is focuses on the sector of the big appliances (dishwasher, washing machine, dryer, oven, hob, hood, fridge, freezer) both for domestic and commercial use. In this research the author will refer to them with the term *appliance* even if in the commercial sector the word *equipment* is more used. If taking for example the domestic segment which is the closest to everyone life and experience, the market seems blocked considering the functionality of these appliances: boxes of sixty cm to be filled perfectly in the space of our kitchen or laundry rooms which use a large quantity of resources as water, energy, detergents and at the end of the cycle throw out them with a lower quality as grey water or the heat dissipated. For an example see the image of a comparison of a washing machine in year '50s and in '2000s in Electrolux website (n.d. a). The main changes can be seen considering the energy (and water and noise) efficiency, thanks mainly to the energy label (EC, n.d.); the shift from electric to electronic equipment; the materials of the boxes, from metals to plastics. Considering the aesthetics, it is focused

mainly on the front door, where displays were added, and the old style is still considered fashion, for example, for the iconic SMEG 50's style collection (Smeg, n.d.). In recent times they have become smart devices with digital touch screens that can be controlled remotely and in some versions, they can collect data about resource consumption and product condition, however this innovation is inserted only in the most expensive versions.

Even if these appliances are part of the system kitchen or laundry room, the interactions between them are not really considered, except in particular cases of smaller systems as the one to cook - hob-oven-hood -, to preserve food - fridge-freezer - or to clean clothes - washing machine-dryer -. However, the relationships are only aesthetic ones (they look good next to each other) or technological (e.g. they can be controlled by the same applications if produced by the same producer). In some cases they share components as the LG WashTower™ (LG, n.d.) but never resources such as water.

This paper is part of a research project that wants to understand how to design appliances for the CE scenario - a current problem than a future one - with the application of a systemic design (SD) approach (Battistoni et al., 2019) to tackle the complexity of the topic and consider the potential relationships among them and with other systems.

Methodology

The traditional role of designers has changed over the years according to Sanders and Stappers (2014), from exploring *how to design* to *what to design* and to *“work to help ensure that what is designed makes sense in the future lives of people”*(p.25). As today the role should also be to ensure *to not harm the natural environment*. For this reason, this research wants to understand how to design appliances in the CE scenario with the following research questions: *If the task is to design an appliance, is there the need to re-design the current one, design new ones, or invent something else?; How to decide what to design in the context of appliances for a CE scenario?; Are we considering all the aspects of the question?* An inductive and deductive research approach was used to find the answers. The problem was tackled using a SD approach and the tools of the Holistic Diagnosis (Battistoni et al., 2019). The first step of the research was to consider the topic as a complex system where multiple aspects need to be considered to add more content for the design process. The personal research experience was helpful in creating the background. A literature review was conducted to understand recent contributions from the design for the CE to the design of appliances and the EEE sector, to other aspects related. It was also chosen to include more inclusive databases, such as *Google scholar* and *Research gate*, to intercept contributions outside academia. This review was integrated with research on design projects/products to understand better the state-of-the-art.

Examples of Disruptive Solutions

The path towards becoming boxes with standard dimensions and functions wasn't straight. One example is the dishwasher 1959 *D10* known as *The Round Jar* by Electrolux (Electrolux, n.d. b) a model to put on the top of the kitchen that could wash dishes for five people in eight minutes. Another example is the *W20* by Electrolux (n.d. a) which included a dryer and a washing machine with a floating wing “..allowing users to start the next load in the washing machine while drying the first at the same time” (Electrolux n.d. c). They required more effort by the householder than pushing only a button as we do today, but they were answering other requirements that today are not addressed as, for *D10*, the lack of spaces in some kitchens for a dishwasher or the lack of enough daily dishes for singles in comparison to families.

Considering more recent times, a first scouting of recent solutions found interesting projects, although most remained concepts. They were grouped into three categories: a) product; b) system *kitchen/home*; c) product as a service - a CE business model (Tukker, 2015).

Product:

- project (washing machine) *BioLogic* by Whirlpool (Behance, 2012) by designer Patrizio Cionfoli, which uses plants to filter the water;
- project (dishwasher) *kitchen sink dishwasher* by Electrolux (Fiore, 2018) a sink that can become a small dishwasher with a lid;
- project (fridge) *Oltu* by Fabio Molinas (Molinas, n.d.; Fiore, 2018) that uses heat dissipated by the fridge to cool the vegetable container;
- project (fridge) by Dominique Perrault for Fagor (Domus, 2001) which uses the heat produced by the fridge to create a greenhouse for aromatic plants.

System Kitchen:

- project (kitchen) *Flow 2* by studio Gorm (Studio Gorm, n.d.; Fiore, 2018) which considers the entire kitchen and uses some innovative solutions as the evaporative cooling fridge box;
- project (kitchen) *Green kitchen* by Whirlpool Design (2013) that through the connections among the elements permits saving up to 70% on energy bills;
- project (kitchen) *Larder* part of the microbial home system by J.&W. Arndt for Philips where there is an evaporative cooler and a vegetable storage on the dining table (Domus, 2011; Fiore, 2018).

Product as a service:

- *Wash Bar* (Tripadvisor, n.d.), is a self-laundry bar where people can wait during the washing cycles. In this case the clients buy the service of *washing clothes* and not the washing machine.

Literature Review

A brief literature review revealed many different connections to the world of appliances with:

- energy as technologies for energy efficiency (e.g. Bansal et al., 2011);
- market, as in specific context the Netherlands by van't Klooster (1985);
- smart as the use of sensors (Lahrmann & Tschulena, 2005);
- health as problem of the production of magnetic field (Gauger, 1985);
- safety as in the use for all from children to older (Russell, 2010);
- use and management of resources as on-site grey water treatment with wetland (Patki et al., 2022);
- manufacture as the use of particular materials (glass ceramics by Willhauk & Harikantha, 2005);
- life-cycle as related to the Rs like Remanufacturing (Kang et al., 2021);
- related to Design field as:
 - design practice as the configuration of domestic practices by Chabaud-Rychter (2018);
 - relation to SD (Fiore, 2018);
 - packaging as Landi & Cicconi (2021).

Considering the design strategies and guidelines definition presented in the introduction, the research which shares more similar characteristics with this, the EEE sector and the circularity, is the one by Berwald et al. (2021). They identified five main guidelines that work at product Level - from start to concept - and at part Level - from concept to production.

In the field of CE it is valuable to mention the definition of circular business models specifically applied to product design as the review by Lüdeke-Freund et al. (2019) and the study by Bocken et al. (2016): narrowing (using less), slowing (using products longer), and closing resource loops (using materials again). The Ellen MacArthur Foundation (2019) identified the following strategies to close the technical cycle in the CE, highlighted in the *butterfly diagram*: share, maintain/prolong, reuse/redistribute, refurbish/remanufacture, recycle. A CE is a restorative and regenerative economy, in this context not only *Design for sustainability* is recommended to follow but also the *regenerative design* which looks to renew and revitalise the energy and materials used in product design often reached by biomimicry (Cole, 2012, cited by Geisendorf & Pietrulla, 2018).

Also the work by the European Commission about the ecodesign and the electronics is important to cite: from the work in 2012 (EC, 2012), the new rules for more sustainable household appliances published in 2019 (EC, 2019), the new Ecodesign and Energy Labelling working plan 2022-2024 by EC (2022) that will take in consideration also professional dishwashers and washing machines, and moreover the repair score system in order to incentivise the reparability just initiated by the EN 45554.

Result: The Framework

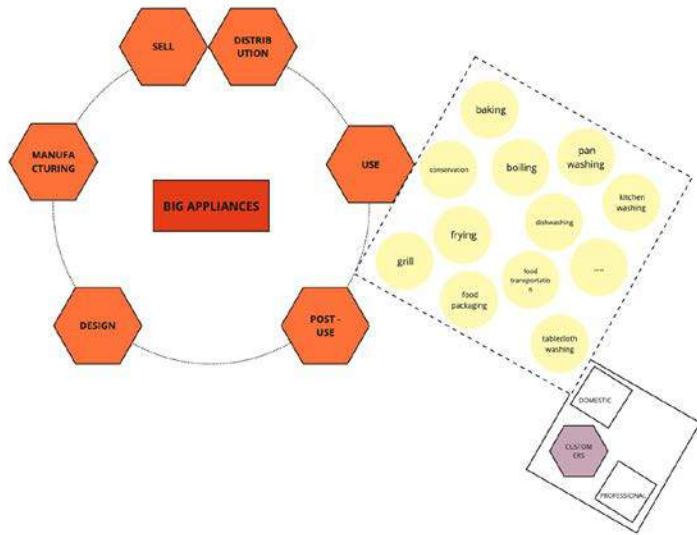
The amount of data collected by the previous research steps has highlighted the necessity of creating a framework that can contain all the information, not only like a written database, but that can visualise the complexity of the topic. Indeed, if a systemic thinking approach is applied to this category of products, multiple relations can be found with multiple sectors and research topics/fields. Therefore, if the increase in complexity becomes challenging to manage by the designer/researcher, one way is to visualise it and use a tool from the SD field, the *giga-maps* (Sevaldson, 2018). The framework created can be categorised as a system mapping and has roots in the Holistic Diagnosis method of SD, also sharing common features with the ecosystem mapping.

The framework started as a concept map and was developed with the open platform *Miro*. This platform was chosen to make this work, not just a private tool for the researcher, but collaborative and remotely accessible that can effortlessly include external contributions to help researchers/designers to map all the implications that the design of appliances in the CE scenario should consider in the process.

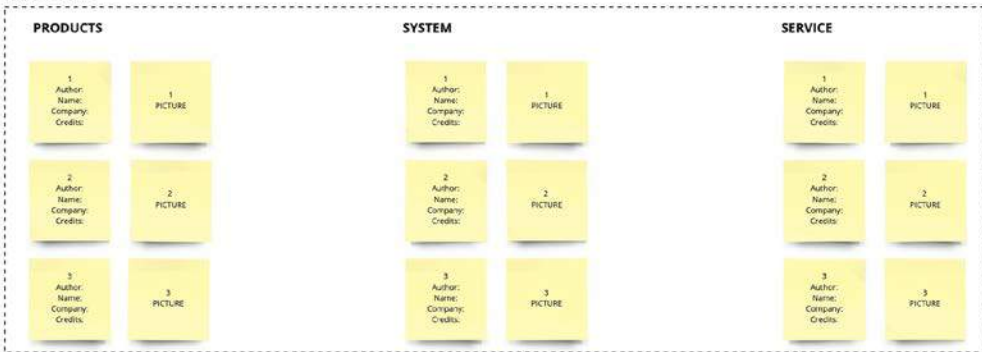
The framework is accessible at this link:



In the creation, the first step was to put at the centre the focus point (big appliances) and then adding around connections with all the main phases of their life cycle (Design, production/manufacturing, sell/distribution, use/consumption, post-use/end of life). Another first connection was created with the activities strictly connected to their use, and the context where they are used: domestic or professional. A box below is dedicated to inserting the information about the case studies Fig. 1.



CASE STUDIES



Starting from these phases, the chain was reconstructed, adding the CE business models (orange) and connecting, for example, the manufacturing with the typical elements of the supply chain, and the design phase with the elements found in the literature review Fig. 2. A box on the left was created to insert the design strategies found and their specific guidelines.

Fig. 1 The starting point of the framework. Image created by the author with Miro.

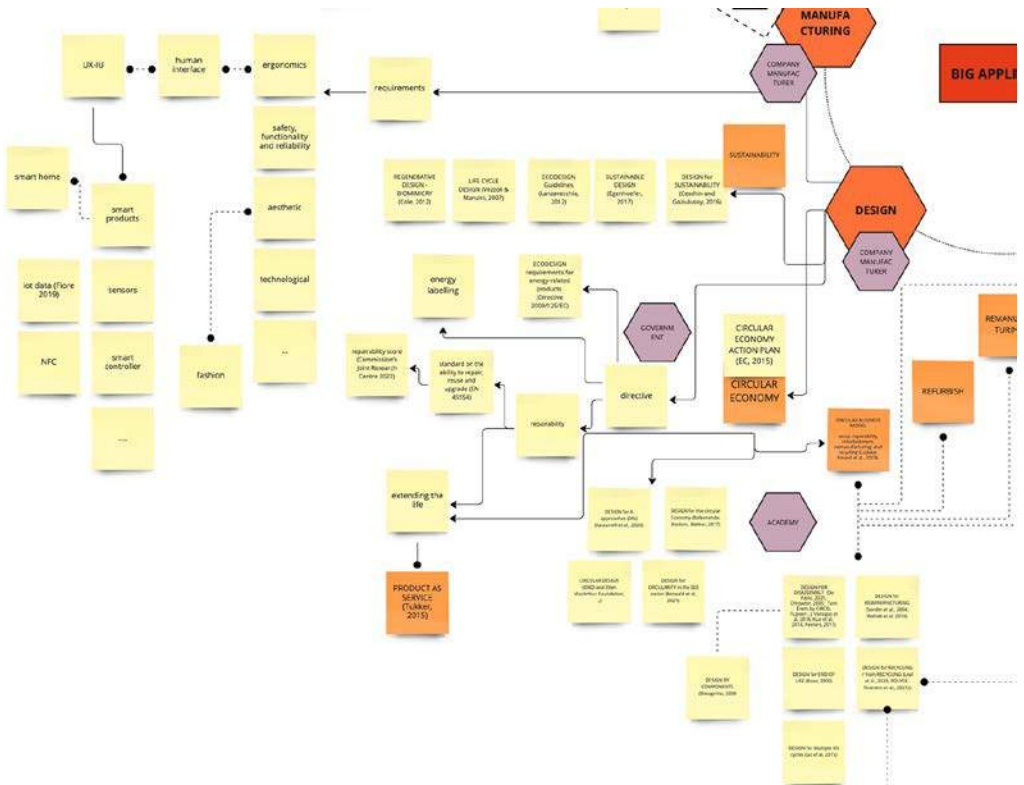
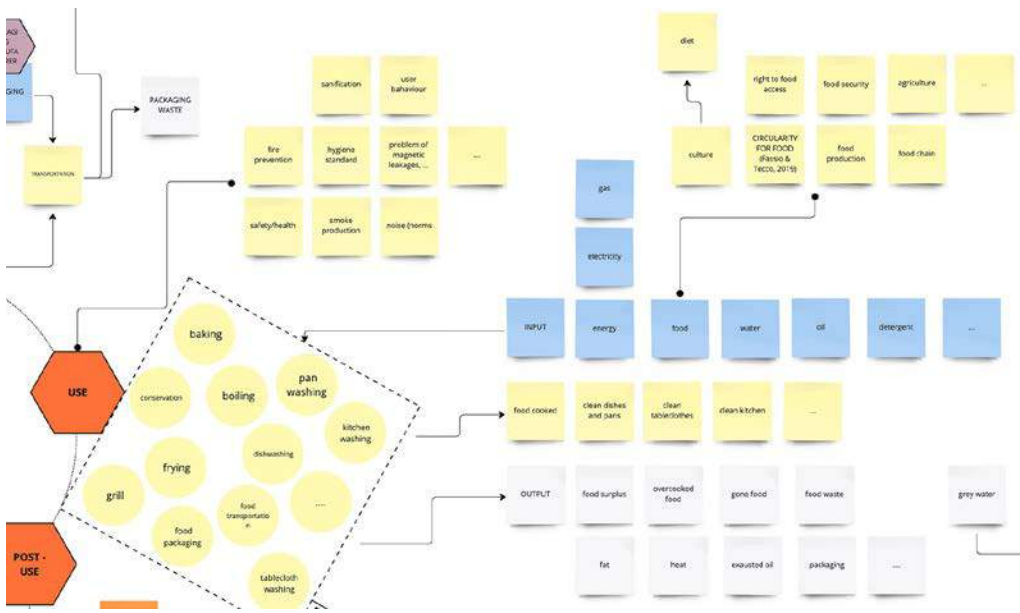


Fig. 2 Focus of the framework on the design phase. Image created by the author with Miro.

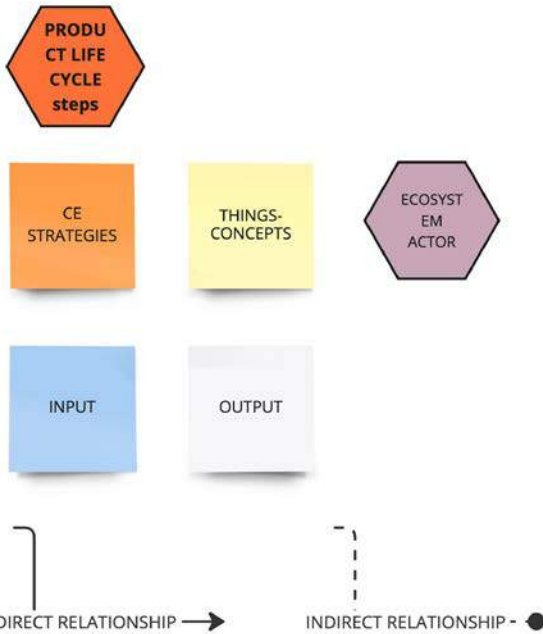
In many cases, information about the flow of resources used in input and output was added. Along with the resources such as energy and water used to work the appliances, also food is considered as an input for the function of some appliances Fig. 3. In this case for example it was added the connection with the research by Fassio & Tecco (2018) on the circularity of the food system.



A certain logic and hierarchy was used to insert the different elements, distinguishing from concepts, resources, actors and relationships Fig. 4.

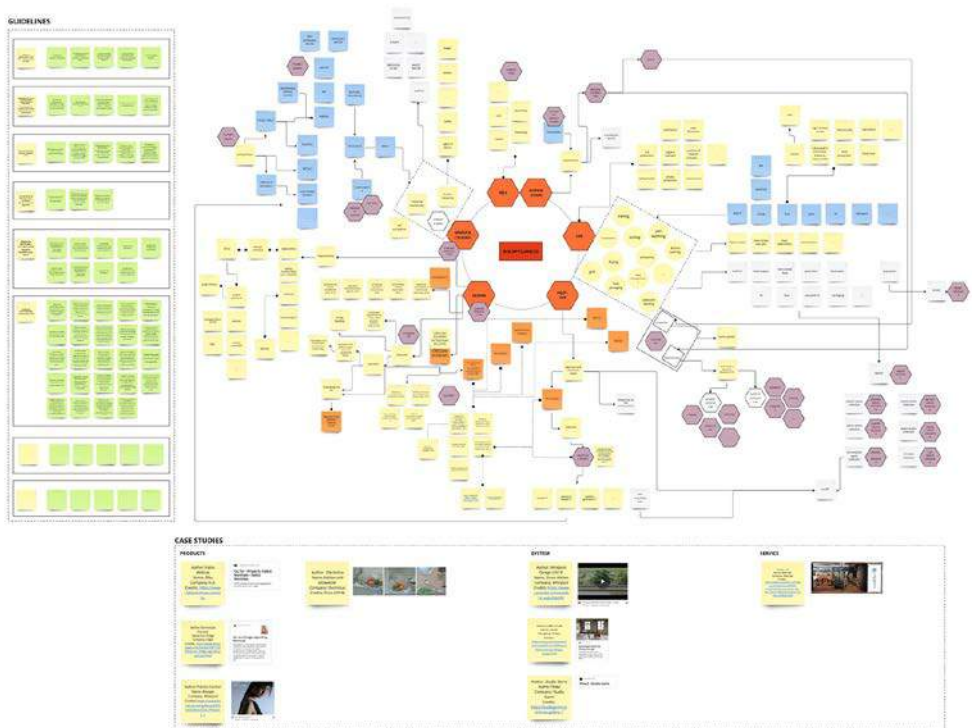
Fig. 3 Focus of the framework on the connection with the food sector. Image created by the author with Miro.

Fig. 4 The logic used to insert the elements and their hierarchy. Image created by the author with Miro.



Moreover, a layer about *ecosystem mapping* was inserted to complete the analysis - actors in hexagons in purple - that comes from the definition of the *business ecosystem* by Scaringella & Radziwon (2018) and from the *circular economy ecosystem* defined by Aarikka-Stenroos et al. (2021).

The complete result is shown in Fig. 5.



Discussion and Conclusions

As reminded by this conference's track, design needs urgently to move from human-centred to a systemic planet-centric vision. This means to design for a CE scenario, and for complex systems where more aspects need to be considered in the design process and where the leverage points for the change can be identified. This research and its result, the framework, wants to implement and facilitate this phase. The result is in progress and wants to be the start of a co-designed process with the contribution of external workers in the field to become a useful tool for the design phase. The next steps of the research will be to do the demonstration phase with data collection (observation, feedback forms, interviews, discussions, brainstorming, expert evaluation, field notes), to test the tool's utility through workshops, to communicate the tool and invite collaboration.

This research and the tool can contribute to the theory about sustainability tools that are developed for the CE scenario, but also to practice because it supports early and quick visualisation of prob-

Fig. 5
The complete framework with data inserted in September 2022. Image created by the author with Miro.

lems and opportunities to these kinds of products but also of the researches in the field.

A future work can be to add another layer about the consequences that some resources and their management have on the natural environment and to insert specific data of the resources used (input-output) regarding the quantitative and qualitative level (learning from the SD approach).

The tool can be easily adapted to different contexts (as different categories of products, domestic or professional,...) because some relations can be changed easily, improving the replicability and scalability of the tool.

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Digital Fashion Technologies & Practices: Design Driven Sustainable Transition in Fashion Industry

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Abstract

Contemporary clothing manufacturing, purchasing and consumption models have made the fashion industry the second most polluting industrial sector. This contribution aims at analysing promising technologies, methodologies and practices that are tackling environmental sustainability issues related to the fast-fashion industry. The contribution analyses how, leveraging on technology innovation, the combination of tangible processes, such as the selection of production means and materials, and intangible practices, such as digital fashion, designers can contribute to the sustainable transition of the fast-fashion sector mediating between customer expectations, production economy constrains and environmental sustainability.

Keywords

Fast fashion

Digital fashion

Sustainable transition

Design driven innovation

Enabling technologies

Fast Fashion Environmental Impacts

Contemporary clothing production, purchasing and consumption models have made the fashion industry the second most polluting industrial sector. Every year, it is responsible for more emission of greenhouse gases than the aeronautical and naval industries combined (European Environment Agency, 2022). Its production methods pollute rivers and degrade soil contributing to biodiversity loss (McKinsey cited in Ellen MacArthur Foundation, 2021). Synthetic materials, which most clothes are made from, spread into the ocean in the form of microfibers.

During the last 20 years, clothing production has doubled whereas the use life has significantly shortened: it's estimated that each piece of clothing is worn 7-10 times on average before it is thrown away (Grand View Research cited in Ellen MacArthur Foundation, 2021). 87% of disposed clothing goes to landfill or it's burned and only 1% is correctly recycled (Textile Exchange, 2020). One reason for this is that textiles are made from complex intertwined threads (Fashionary, 2020) connected to hard components such as accessories, buttons and fasteners which are difficult to disassemble during disposal (Fantin et al., 2020). Such environmental impacts are amplified in the fast fashion sector: a production-consumption system characterized by a fast and dynamic creative process that allows brands to bring to the market new products every week. Fast fashion creates a globalized distribution that exploits standardized production delocalized in low salary countries where brands commission production to third-party factories avoiding direct production risks (Jayot, 2020). As highlighted by Jayot (2020), fast fashion is characterized by a continuous offer of new products that generate a fast esthetical obsolescence and a global standardization which steps away from customer's desire of individualism and customization.

This production-consumption model has a strong impact also on social sustainability aspects such as the working conditions of factory workers: starting from the 2013 events of Rana Plaza, where a building hosting 5 garment factories collapsed due to heavy production machines overloading the structure (Allchin & Kazmin, 2013), the Fashion Revolution movement (<https://www.fashionrevolution.org>) is trying to raise awareness among citizens, governance and companies about fast fashion social, economic and environmental impact, promoting more sustainable working condition in the fashion industry.

This contribution aims at analysing promising technologies, methodologies and practices that are tackling social and sustainability issues related to the fashion industry in order to evaluate which design driven approach can help the fashion industry transition towards a more environmentally sustainable system.

Materials & Technologies Circular Transition

More sustainable and circular processes that involve the whole production chain, starting from raw material sourcing to product disposal, are necessary for containing environmental impacts of the fashion industry and, in particular, those of fast fashion (Earley

& Goldsworthy, 2015; Goldsworthy et al., 2018). Fast fashion is a complex productive system that involves a number of actors operating under strong economic and competitive stress (Niinimäki et al., 2020). In order to foster this transition, the fashion industry needs to adopt new design-driven approaches that combine circular and sustainable manufacturing process, conscious materials selection and the promotion of responsible consumption models (Circular Fashion, 2018; Coscieme et al., 2022; Goldsworthy & Earley, 2018).

The use of smart manufacturing technologies allows production optimization, making prototyping and production phases faster, cheaper, and more sustainable. The digitalization of the design phase, and in particular the use of 3D textile modeling software to visualize the relationship between shape, pattern and textile waste production, represent a significant support towards zero-waste production processes (McQuillan, 2020). By way of example, the knitting machine manufacturer Shima Seiki produces knitting technologies capable of making an entire garment from a single thread with a single machine by composing it in 3D (Moore & Smith, 2020). Such technologies, which work by addition not subtraction (Conti & Motta, 2019), make it possible to only consume the needed resources for the garment production, limiting industrial and pre-consumer textile waste.

The designer, as a mediator between disciplines (Celaschi, 2015), must know and handle such technologies to identify design strategies that accommodate their use. Knowledge of textile recycling technologies is also necessary: chemical composition, colors, and the presence of rigid parts are just few of the factors influencing the possibility of recycling clothes (Eppinger, 2022; Karell, 2021). Such characteristics are variables that designers need to consider and handle responsibly in order to facilitate the recycling process in a design for the end of life perspective (McKinsey & Company, 2022). These issues are of great interest for the European community since, by 2025, all member states will have to implement services and infrastructure for the separate collection of textiles.

In order to meet sustainability goals, a growing number of companies are making efforts to transition towards a circular manufacturing model, using production wastes from other industries or selecting recycled or recyclable fibers. Designers can characterize a material, identifying its unexpressed potential and introduce one sector's waste into another as secondary raw materials exploiting its potential (De Giorgi et al., 2020). For example, Napapijri's Circular series offers garments that are 100% recyclable since they are made entirely of regenerated Nylon 6. Fibers and accessories are thus recyclable without the need for disassembly since they are made from the same material. Technologies, such as RFID codes, can contain information about the origin of the material and the recycling processes. Traceability and transparency are key elements for users information and education not only about the environmental impact of manufacturing technologies (Niinimäki, 2017), but also on the societal level as they can contribute to the monitoring of the working conditions of fashion workers (Ellen MacArthur Foundation, 2021). In addition, such data-driven technologies can be key to new clothing return policies and facilitate corporate take back services for recycling and reuse.

Customer education plays an important role in reducing the environmental footprint of the fashion industry. A possible strategy is engaging the customer in the customization process of the final product taking advantage of digital tools such as on-demand decentralized production. Such technologies offer customers custom artifacts that can address individual functional and esthetic needs. The Unmade platform (<https://www.unmade.com>), for example, offers companies that want to transition to an on-demand supply chain model a software that allows users to customize the items they purchase within parameters predefined by the brand. Individual orders are integrated into existing production chains and can be produced at the same cost and speed as mass-produced items. Manipulating the matter brings awareness to the customers as it generates amazement and affection to the product building a strong relationship between the user and the manufacture and extending the use-life of the product. (Karana et al., 2017). Dutch designer Martijn van Strien's with *The Post Couture Collective* allows consumers to download, customize, produce, and self-assemble clothing patterns. Each of the items can be customized to the buyer's measurements and aesthetic taste, produced at a local Makerspace, and finally assembled by the user.

Such design strategy can improve the sustainability of this industrial sector in need of a paradigm shift towards a slow-fashion approach that can limit overproduction and overconsumption (Niinimäki et al., 2020). This "super-slow" view of using garments is compared with "ultra-fast" models by Goldsworthy, Earley e Poltowicz (2018). The researchers argue that it is necessary to propose solutions that can sustainably and circularly respond to people's need for continuous consumption. Aware that it won't stop over time, researchers have experimented with the use of low-impact rapid manufacturing technologies associated with the choice of biodegradable materials for the production of responsible disposable clothing.

Digital Fashion as a Tool for Sustainability

The implementation of Industry 4.0 model into the fashion sectors plays an important role in the reshaping of a more sustainable production system capable of activating innovative design-driven manufacturing processes (Bertola & Teunissen, 2018) involving scholars and impacting on a broad context of disciplines, ranging from humanities to science and technology. Therefore, the so-called "Fourth Industrial Revolution" has been described as a model where new modes of production and consumption will dramatically transform all major industrial systems; it has been targeted by many governmental plans as a goal for a sustainable future. While general frameworks describing 4.0 paradigm are codified and accessible, implementation strategies and their implications on specific local and sectorial systems are largely unexplored. Starting from this assumption, this paper aims to provide insights on the current state of the art and major trends of the "Fourth Industrial Revolution", possibly identifying its impacts on the textile and apparel industry. Design/methodology/approach From a methodological standpoint, the study approaches the topic from the perspective of fashion

domain experts which can contribute, with a positioning essay, to better understanding Industry 4.0 (I4.0). In the field of fashion 4.0, digital fashion refers to three levels of digital technology implementation: product development and visualization, marketing and communication, virtual clothing and accessories (Särmäkari, 2021). Acting on these three levels can contribute to diminish the environmental impacts of the fashion industry leveraging on the different phases of product design, manufacturing, communication, distribution, consumption, disposal and on the object of the production itself.

Digital fashion is a topic of growing interest among academic researchers and practitioners (Joy et al., 2022; Noris et al., 2020). Further accelerated by the pandemic, a number of important fashion brands and companies have shown interest in the digital fashion market. The need for new virtual touchpoints with clients that could substitute those inaccessible because of the pandemic has opened an opportunity for brands to establish new ways to connect with clients. Balenciaga's Fall 21 collection *Afterwards: the age of tomorrow* (<https://videogame.balenciaga.com/en/>) was presented digitally using a videogame that could be played directly on a web browser. This kind of communication channel opens toward a younger audience, that of Gen Z, which is more used to interact with brands via social media and digital channels. Although in Balenciaga's presentation interactivity was limited to the virtual environment exploration, it introduced an innovative approach in how fashion show could be conceived compared to runway steaming and fashion movies. The look book, which has been shoot with real models and clothes, recalls the poses and the feel of avatar selection screens in videogames suggesting that the collection was not specifically designed for either the physical world or the virtual one but for both or, possibly, for an overlapping space where tangible and intangible spaces coexist.

The dialogue between the fashion industry and the videogame medium has also developed into new product categories designed and sold as digital only wearables. Gamers' contribution to the customization of virtual avatars, with both original designs and fan-made collections inspired by official branded releases, raises questions about the commercial relationships with fashion brands and trademarks in digital mediums (Gibson, 2021). When entering the digital domain and the videogame market, digital fashion opens to the opportunity to build a common ground for new consumers and brands where it is possible to co-create and share value beyond the tangible identity of the artifact. The development of social media platforms, fashion blogs and digital tools enable people outside the fashion system to participate actively redefining the hierarchies of fashion communication and the consumption paradigms, allowing for a more transparent, participatory and diverse industry (Crewe, 2013).

That of digital fashion is a developing market and the effects, however, one of the promising impacts could be its contribution to the optimization of production costs and to the diminishing of waste production. For example, fashion brand marketing and communication strategies leverage on social media platforms and influencers to promote new products and collections. Thanks to Augmented Reality technology, physical products could be advertised via their digital counterparts even before mass production gathering data about sales prediction and adjusting production volumes accordingly.

Platforms like Dressx (<https://dressx.com>) offer the possibility to buy and virtually wear digital clothes: the user uploads a picture and the garment is fitted on the body. Pictures are then generally shared on social media by the users and wearing clothes online will eventually be extended to video calls, AR filters, and custom avatars.

As seen in the previous paragraph regarding physical products, customers' involvement in the co-creation of new products contributes to build a stronger relation not only with the brand values but also with the product themselves. A more emphatic relation with artifacts, fostered by hybrid physical and digital touchpoints, could generate more conscious consumption behaviors. The Fabricant (<https://www.thefabricant.com>) is a fashion house designing digital-only clothes who is building a Web 3.0 platform where users can customize and trade digital garments with the goal to build a decentralized fashion economy where participation and co-creation is at the center of the fashion industry innovation.

Although the production, distribution and consumption of virtual garments has an impact in terms of resources consumption and CO2 emission, unlike physical products, some of the environmental impacts of the fashion industry (such as waste production and disposal) doesn't affect virtual products. Virtual products could represent a possible mediation between our society's continuous consumption needs and environmental sustainability limits (Lehdonvirta, 2012). However, it is worth noticing that the virtual product market has been recently characterized by a significant use of blockchain technologies for digital assets acquisition and transfer. Such technology, and in particular the Ethereum Network, is used to avoid digital counterfeiting and introduce artificial scarcity but it is characterized by a significant impact in term of energy consumption undermining the digital fashion contribution as a sustainable alternative to the continuous consumption of physical products (*Ethereum Energy Consumption Index*, n.d.). Recently, more energy efficient blockchain consensus mechanism are being developed and adopted (Bach et al., 2018) and in September 2022 the switch from a *Proof of Work* (PoW) to a *Proof of Stake* (PoS) consensus mechanism allowed the Ethereum Network to considerably lower its energy consumption. The evolution toward more efficient blockchains, the development of more fluid customer experiences and the integration of blockchain-based trading system in digital platforms users are already familiar with, could foster the growth of the virtual product market.

Conclusions: Tangible and Intangible Practices for a Sustainable Transition in Fashion Industry

More sustainable production chains and more environmentally aware consumption models are necessary for the future of the fashion industry. The combination of tangible processes, such as the selection of production technologies and circular materials, and intangible practices, such as digital fashion, can constitute a range of suitable approaches to support designer's contribution to the sustainable transition of the fast-fashion sector. The hybridization of strategies acting both via tangible and intangible approaches can facilitate a smoother transition for users whose sensibility for envi-

ronment-related matters and interest and familiarity with digital tools and products is growing. Leveraging on technology innovation and on a strategic view over the fashion industry evolution, companies can sustain an ecological transition for the fashion industry and, at the same time, build new value for customers.

The use of digital technologies in the field of fashion has favored the emergence of new product categories, professionals and companies operating in virtual clothing production and commercialization. Consequently, also employees digital skills are expected to be considered more relevant and strategic by fashion companies requiring fashion curricula to be updated and integrate ICT competences (Nobile et al., 2021). This can represent a great opportunity for designer to be at the center of this sustainable transition in the fashion industry developing design driven approaches capable to mediate between customer expectations, production economy constraints and environmental sustainability.

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Material Resources as a Contextual Complex System

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Abstract

To respond to the ongoing cultural, environmental and economic changes, the contribution investigates how sustainable development always refers to the context. It demonstrates how the multidimensional interpretation of resources might lead to sustainable design actions.

The article presents a research project aimed at an original mapping of the presence and use of material resources in local supply chains, in order to rethink their sustainable use through design interventions. According to the definition of “contextual attributes” as a filter of knowledge related to the technical, expressive and cultural aspects that a material brings with it as a resource of a specific context, the research objective is to develop a tool for designers that can help to outline criteria for the knowledge, valorisation and sustainable use of materials by recognising their attributes.

Keywords

Material driven design

Context

Local resources

Sustainability

Know-how

Design, Materials, Sustainability

The contemporary world requires a rethinking of design theories and practices that might offer proposals compatible with a systemic and sustainable dialogue between companies, design and the territory as a material culture heritage. Specifically, the research trends in design of materials are oriented towards the development of materials that comply with sustainability criteria. There are many design approaches which intercept environmental, social and economic needs, in order to promote tools of understanding and practicability of the paradigms activated by the circular economy (Solanki, 2018; De Giorgi et al., 2020; Pellizzari & Genovesi, 2021; Bak-Andersen, 2021; Brunner, 2021).

When one is seeking to understand the value of materials it is necessary to consider the analysis of their flow within a system defined in space and time (Brunner et al., 2002) and this shows that the origin of raw materials is important: the closer is the source, the more accessible these resources are to the designer. Materials are part of the collective and individual experience and are indicators of the technological level of a society, as well as of its values (Papanek, 1971), emerging as “social actors” (De Giorgi et al., 2020): not elements per se, but connected to society’s history, culture and values, thus determining a reciprocal influence between design actions and the establishment of new models (Zucchi & Collina, 2016).

Sustainable development therefore always refers to the context (Bak-Andersen, 2021), which means that design solutions are needed to support the use of local material resources. This is why it is crucial to explore the opportunities of innovative materials resulting from the optimisation and recovery of resources (Paoletti, 2021), defining design methods and tools to develop transition processes towards a circular economy, in which the understanding of technical and expressive value of materials determines a more sustainable use of resources. In this way, the unexplored potential opportunities of raw materials, production waste and post-consumption materials, can be made evident (Lefteri, 2021; Solanki, 2018; Pellizzari & Genovesi, 2021).

Designers are called to understand this scenario and this is why a material driven systemic design approach for sustainability (Bak-Andersen, 2018) can make the designer aware of the very dense network of multidimensional relationships that a material brings with it, in order to activate true sustainable design processes.

Learning From the Context

An in-depth knowledge of the context in its natural, social, economic and cultural multidimensionality is fundamental to design in an innovative and sustainable way. Fagnoni refers to “territorial capital, a stratification of know-how and identities, activities and resources, forms of governance and relations, products and landscapes” (2018, p.17): only through such an analysis it is possible to gain an understanding of the territory and to identify real needs and latent needs, as well as strengths and weaknesses, in order to offer new possibilities of action to the design practice and to the territory itself.

By highlighting the potentials of a society, a company, a territory and “enhancing these elements to trigger a change of mentality among people, in favour of social, environmental and economic sustainability” (Tamborrini & Stabellini, 2018, p. 55), it is possible to inspire design innovation.

In response to the ongoing cultural, environmental and economic changes, this contribution presents a research study aimed at mapping the presence and use of material resources in local supply chains, to rethink their sustainable use through design interventions. On the one hand, it can convey the profound meaning of belonging to an unique material culture; on the other, it can enhance positive effects on the territory itself and on production systems.

The project, which began with a research fellowship and is still in progress in relation to a broader research project at Università Iuav di Venezia, aims to develop tools for the generation of knowledge to make evident the as yet unexplored opportunities of the materials. This hypothesis requires a theoretical framework that sets materials at the centre of the relationship between territory and design (Bassi et al., 2021). From such a perspective, materials emerge as part of the collective and individual experience acting as “social actors” (De Giorgi et al., 2020) that can determine a mutual influence between design actions and the establishment of new planet-centric models.

The research objective is to configure a tool for designers, which can contribute to outline criteria for knowledge, valorisation and sustainable use, starting from the recognition of the peculiar qualities of materials. This process aims at interpreting the paradigms activated by the circular economy in order to determine design trajectories that can make evident the unexpressed opportunities of materials.

The tool presented in this contribution would then act as a driver to optimise resources and local supply chains, and to enhance positive effects on the territory itself and on the local production system. Actually, design is the discipline which can interpret technical, economic, social and cultural transformations, coming into close contact with the specific dimension of the territorial context: once the identity of a local production system – in this case the tanning one – has been investigated, designers become the locally enabled terminal through which design affects the processes of competitive enhancement of a single company and of local systems of companies.

Mapping the Multidimension

Two main fields concerning the knowledge of materials can be identified in the literature: one concerns the technical-functional aspects, the other concerns the expressive-sensorial ones (Ashby & Johnson, 2010). While on the one hand the performance of materials is investigated, on the other hand one can explore what materials communicate and evoke in the relationship with users (Karana et al., 2015).

A further interpretative dimension for sustainable design of materials, presented in this contribution, is provided by what we call here “contextual attributes”. It means the dense network of multi-

dimensional relationships in which a material is involved and which makes it necessary to explore a material by analysing it in relation to its context (Solanki, 2018; Bak-Andersen, 2018).

For this purpose, the collective workshop proposed by the author since 2020 to the students of the Materials for Design course, held by professors Alessandro Mason and Riccardo Berrone within the Product and Visual Design curriculum of the Bachelor Degree in Design at Università luav di Venezia, is carrying out a mapping of materials starting from a local geographical recognition, in order to demonstrate how the contextual and multidimensional interpretation of resources can enable sustainable design actions (Bak-Andersen, 2018).

In the first phase of the workshop, a mapping of the students' places of origin was carried out in order to define and visualise the relationships between these places and their material heritages (Fig. 1).

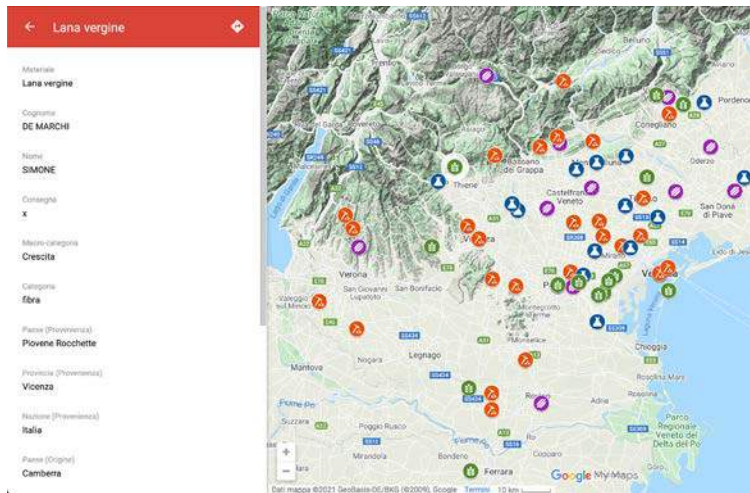


Fig. 1 Michele De Chirico and Alessandro Mason. Università luav di Venezia, Workshop, 2021. A mapping of materials starting from a local geographical recognition. Contextual and multidimensional interpretation of resources can enable sustainable design actions.

The second phase involved the students in a field research – in the Triveneto area – by interacting with producers of materials, in order to investigate the origin of raw materials and the provenance of materials once they became semi-finished, to understand their production processes and technical properties. The study was carried out by collecting information that describes material resources in multidimensional terms: geo-historical, cultural, functional, technical, economic and ecological ones (Bak-Andersen, 2021), so we are dealing with both quantitative data – available from technical datasets – and qualitative data – the result of ethnographic research.

The research showed how these “contextual attributes” can filter the knowledge related to the technical, expressive and cultural aspects that a material brings with it as a resource of a specific context: a material has its own history, characterises a place, transforms a territory in geological as well as socio-economic terms, and has an influence on the people living in that context and on the resulting job possibilities, even before being used as a material for a product design. The investigation of the applications and uses to which materi-

als are employed, also provides further knowledge about the perception and value that users attribute to those materials.

In an early stage, it was necessary to report the researches by documenting them in the form of a booklet, which allowed the presentation of the topics (Fig. 2).

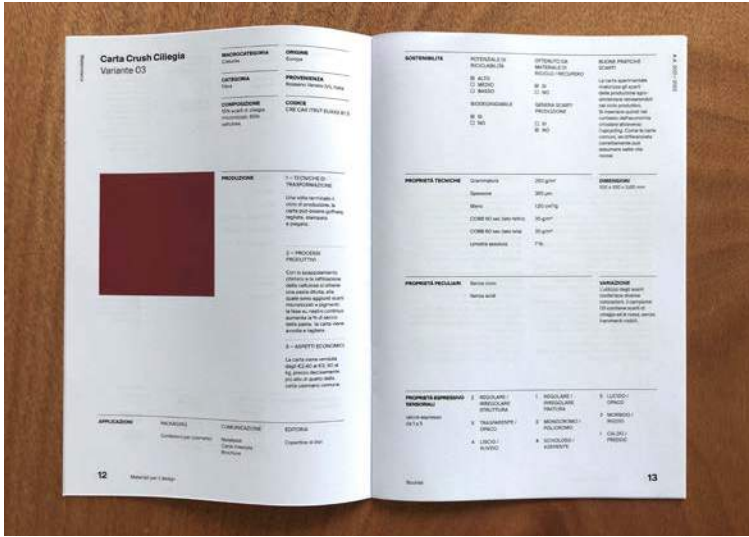


Fig. 2
Michele De Chirico and Riccardo Berrone. Università Iuav di Venezia, Workshop, 2022. Research reports are documented in booklets. Students: Francesca Affatati, Emilio Dalpane, Loredana Tomat.

In a second stage, all the data was collected in cards – which support the cataloguing of the collected samples – as well as in a dataset useful for the realisation of a visual digital localisation that intercepts information on the provenance and origin of the materials (Fig. 3).



Fig. 3
Michele De Chirico and Riccardo Berrone. Università Iuav di Venezia, Workshop, 2022. Research data are documented in cards for each material sample. Students: Francesca Affatati, Emilio Dalpane, Loredana Tomat.

An important aspect of the study concerned the mapping of sustainable actions related to these resources, so the potential recyclability of the material was reported; as well as whether the examined

material was biodegradable, or the result of waste regeneration, or materials recycling; and also the type of production waste related to each process phase for each material was reported.

This thinking-by-doing approach confronts us with the need to re-engage in the relationship with matter, to understand what matter itself can suggest. In the experiments, even self-made tools allow us to confront the relationship between abstraction and materiality, enabling us to understand much more quickly the variations in meaning that material can take on. In this way, the designer can bring his or her own specific contribution regarding the use and perception of functions, connections, and relationships between material resource and project.

The third phase of the research concerns, indeed, the design for sustainable management of production waste and was conducted by the author starting from one of the case studies collected and documented by students. The case study concerns the tanning supply chain and, by implementing design trajectories of hands-on experiences as an act of enabling knowledge of materials (Bak-Andersen, 2021), has led the author to the framing of a methodology related to the ways of both organisation and design interpretation of material resources.

Tool Prototype

The development of this methodology is aimed at formulating a tool to overcome the notion of residues as waste, by conveying the semantic value of production residues as resources. Such a semantic transition is driven by their nature as tangible outcome of the metamorphosis of matter, in other words the tangible outcome of the transformations that take place during the process phases of a specific know-how.

The integration of production residues within experimental design processes has been mediated by their expressive-sensorial qualification, an interpretative filter drawn from the studies inherent to the research field of materials experience (Karana, 2010; Del Curto et al., 2010; Rognoli & Levi, 2011; Carullo et al., 2019). Materials experience concerns the meaning of materials as enablers of experiences mediated by the senses and as vehicle of cultural meanings. Actually, material culture can be defined as the transition of the intangible aspects and values of a society onto the tangible world around us (Woodward, 2019). This explains the choice of exploring the meaning of materials through the analysis of the experiential qualities that will be transmitted in a product: these aspects may be difficult to measure, but they are fundamental for the sustainable design of materials as they allow us to appreciate the perception that people will have of that material and the connotations that will be attributed to it (Karana et al., 2015).

Through the identification of design macro-actions and of technological transfers, it was possible to set up many material concepts (Fig. 4) and then the prototype of a visual cataloguing system (Fig. 5), which can convey the valorisation of production waste in the shape of a multi-levels “talking” map (Bruno, 2015): at the same time it is a sensory map as it shows the perceptive pathways and muta-

tions of materials, resulting from the design actions; a time map as it records the succession of the process phases of which production residues are the tangible outcome, and a generative matrix map that proposes a series of suggestions – beyond what has already been described and experimented – which are intended as possibilities of design of materials or of sustainable applications, starting from waste (Fig. 6).



Fig. 4
Michele De Chirico.
Università Iuav di Venezia,
FSE research fellowship:
*Design for the sustainable
management of produc-
tion waste in tanning
supply chain*, 2021. Mate-
rial concepts carried out
through the identification
of design macro-actions.

Sensorial attributes

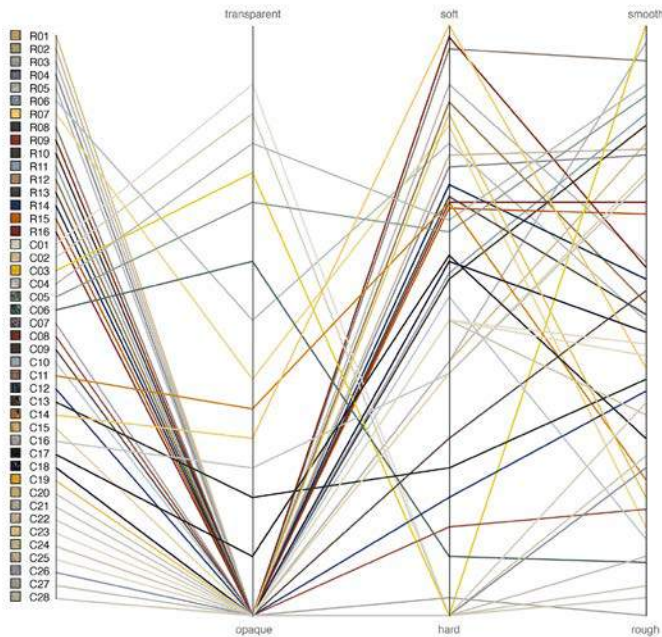


Fig. 5
Michele De Chirico.
Università Iuav di Venezia,
2021-2022. Prototype of a
visual cataloguing system
through expressive-sen-
sorial qualification:
materials as enablers of
experiences mediated by
senses and as vehicle of
cultural meanings. Data
visualisation support:
Jacopo Poletto.

Multi-level map

soft-hard and smooth-rough

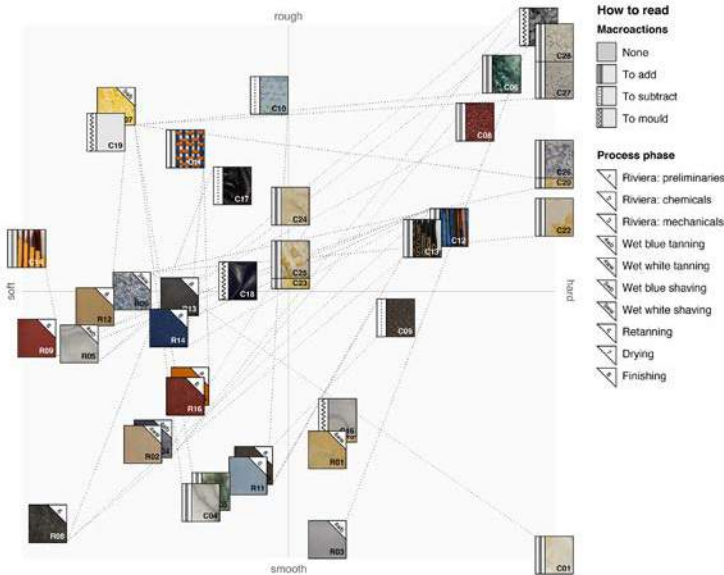


Fig. 6
Michele De Chirico.
Università Iuav di Venezia,
2021-2022. *Talking
map*, an example of the
prototype of a visual
cataloguing system. It is at
the same time a sensory
– time – generative map.
Data visualisation sup-
port: Jacopo Poletto.

The study allowed us to explore the material as a complex system of relationships, data and information, leading to a deeper consideration on its fields of application in design, including an in-depth study of production processes and the possible use of materials production waste. The systematisation of information led to the generation of multi-levels maps (geographical, sensory, temporal) which can be considered as a prototype of a generative tool for the materials selection, based on multidimensional mapping and storytelling of materials.

The outcomes of the research consist of:

- a cataloguing of 160 materials (each one in 3 different variations) coming from the territorial context of the Triveneto, as well as the basis for a materials library service addressed to design students;
- a resulting cataloguing of the related production residues;
- the prototype of a digital tool aimed at “questioning” the materials and at enabling, on the one hand, their selection and use and, on the other hand, generative processes, that means design intuitions beyond what has already been catalogued or experimented.

The richness of this output lies in its ability to catch and interpret the direct relationship between materials, production processes and territories, by analysing materials not only on the basis of their performance and aesthetic qualification, but as part of a complex system. The map enables a movement in the mutations of matter itself, providing both an “organisation of perception” (Carullo, Del Curto & Lucibello, 2019, p. 152) and an organisation of design possibilities.

By allowing this, the tool is proposed as an interceptor of values such as identity and sustainability of a know-how belonging to a territorial and material culture, whose production waste becomes its legacy and *material* for the project. As a legacy of the metamorphosis of matter through the processes of a specific know-how, they emerge as resources that embody a form of knowledge (Paoletti, 2021).

Michele De Chirico
He is a PhD student in Design Sciences at Università Iuav di Venezia. His research relates to design of materials, focusing on design for the sustainable management of production waste and on materials as contextual actors and cultural meaning-makers.

Conclusions

The results presented in this contribution represent the first step towards a wide research project which aims at the creation of a multi-level database, on which specific search filters can be applied, and which would lead to a geographically based materials library as an answer to the design students' need to experience the materials. It would be a service through which students would develop the required knowledge about materials, to use them in their projects.

Providing insights and considerations is fundamental for a cultural and behavioural change in which to outline new production and (non)consumption scenarios based on a systemic perspective, in which the *outputs* of one supply chain become the *inputs* of another.

The next steps of the research concern on the one hand the implementation of the multi-level map prototype, in order to simultaneously convey technical, geo-historical and cultural data, as well as information on the environmental, economic and social impacts, and on the other hand the collection upgrade by cataloguing and mapping other supply chains.

The ambition is to go beyond the pilot case related to the tanning supply chain and to test the methodology on other supply chains.

The search for a tool to interpret a well-known scenario currently in transformation can allow designers to reveal the potential of material resources to contribute in the reorganisation of established structures, systems and production economies, in order to redefine our relationship with both natural and socio-economic systems.

The most promising potential of a material driven systemic design approach for sustainability lies in the possibility of opening up new paths to a design-based and deeply cultural change.

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Diffuse Micro-Factory: Circular Distributed Production System for Microbial Nanocellulose

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Abstract

The global climate crisis and its social ramifications are pushing us to rethink the current industrial system grounded on the paradigm take-make-discard. Designers started looking at nature not only as a model but as a collaborator in the design process, envisioning possible circular alternatives for our production-consumption systems. The research illustrates a diffuse micro-factory operating model for microbial nanocellulose fabrication and retail, grounded on bottom-up and co-design approaches. The aim is to bypass the long lead times which usually characterise the industrial development of new materials, making biomaterials available through everyday products favouring a familiarisation and demystification process. In order to bring structural changes rather than symptomatic solutions, we need indeed to match the techno-scientific biofabrication revolution to a cultural revolution, integrating the scopes of design and science.

Keywords

Biofabrication
Circularity
Systemic change
Collaboration
Living materials

From Progress to Evolution

The ongoing global environmental crisis with its multiple social ramifications is pushing us to rethink the current production and consumption systems through bottom-up and co-design practices, distributed microproduction and circularity of local organic nutrient flows. The current development model, based on the idea of linear progress and incremental growth, has indeed widely proved its unsustainability as well as its responsibilities in climate crisis and social injustices, encompassing climate change, extreme events, health effects, food and water security, livelihood security, migration, cultural identity, biodiversity loss, land consumption etc. (Mearns & Norton, 2010; Commission of the European Communities, 2009).

Consumptive Systems

The majority, if not the totality, of the industrial systems worldwide are consumptive systems grounded on the paradigm take-make-discard, based on resources depletion and waste accumulation. Moreover, their pursuit for exponential growth does nothing but exacerbate their negative impact over time, constantly accelerating and expanding. In the case of fossil-based polymers for instance, since 1950 the annual production has increased nearly two hundred-fold, reaching 381 million tonnes in 2015, equivalent to the mass of two thirds of the world population (Ritchie & Roser, 2018). It is estimated that only the twenty percent of this plastic is recycled, while the remaining eighty percent is discarded or incinerated, contaminating the air we breathe, the water we drink, and the soil used to grow the food we eat, not to mention the amount of plastic debris entering the oceans and affecting the marine fauna. The plastic issue however, which gained growing attention in the last few years, represents just the tip of the iceberg. All global industries from plastic to paper, from cotton to leather, from food to transportation, are consumptive systems. Even all the steps made towards recycling are often just limited to damage control, never tackling the problem at its roots. Recycled materials are not automatically “good” from the environmental point of view, especially if they weren't conceived for recycling (Braungart & McDonough, 2002). In many cases re-cycling is actually sub-cycling, entailing the material loss of value (with the melting of different materials), and the biosphere contamination (since recycled materials can contain even more harmful additives than the original ones), perpetuating in a linear consumptive model just postponing a little bit the end of life of materials without any actual circular approach towards their production.

Besides carbon emissions and pollution, consumptive systems have also a huge social impact, neglecting decent work condition and promoting child labour as happens in the cotton and textile industry (ILO, 2016), as well as polluting third world countries with chemicals prohibited in the EU in order to produce goods sold in the western countries, as happens for leather tanning and manufacturing. There is therefore need to reverse course and learn from nature, who has undergone 3.8 billion years of research and development, in order to be able to adapt to the functioning of the planetary eco-

system based on the equivalence “waste equals food” (Braungart & McDonough, 2002). Life on Earth indeed, is characterised by circularity of nutrient flows and ephemerality of organic materials, which are born, grow and die as any other organism on the planet.

We Are Nature

In recent years, with the growing understanding of the functioning of the world we inhabit thanks to advances in science, the solutions of the artificial world got closer to the ones of the natural world, blurring the boundaries between these two fields until overcoming such dichotomous contraposition. We are now aware that the boundary which for long time separated nature and artifice is actually a cultural construct and we are just part of nature, “organisms among organisms” (Franklin & Till, 2020). It is no longer “humans versus nature”, but “humanity as integral part of nature with each mutually affecting the other” (Mc Quaid, 2019). As human species then, we should aim at expanding the equilibrium condition of natural systems to the human-made ones, learning how to give back the nutrients extracted from the environment into a usable form at the end of life of materials and products.

When envisioning possible alternatives for production-distribution-consumption systems however, we must remember that systemic changes can only be achieved through a radical change of frame. They are the result of accumulation of radical changes on the small scale (Manzini, 2018), of discontinuity and disruption brought by radical innovation as opposed to incremental innovation (Norman & Verganti, 2014), which can just bring improvements in continuity with the existing paradigms. To try to patch up contemporary issues without calling into question the whole system we operate in won't lead anywhere, since it does nothing but legitimise and repurpose the same boundary conditions which generated such issues. It ignores the intersectionality and interconnection among socio-cultural, environmental and economic issues, that are all the result of the anthropocentric view of the world, based on dominion, linearity and progress. In order to achieve real changes systemically we need a radical shift in perspective, starting from revolutions on the small scale to reach the global scale in the next future, by opposing collaboration to domination, circularity to linearity and evolution to progress (Trebbi, in press). Progress moves forward, linearly and incrementally, resulting in a growth in some respects but with very few changes, it's never radical nor disruptive. Evolution instead, works through adaptation processes searching for the most efficient solution for survival, it hasn't an individual definite direction but develops through differentiation according to context (Del Gesso & Trebbi, 2019). Acting through a rhizomatic model, evolution allows us to not focus on one single and partial point of view – so far, the one of the white, western, cisgender, heterosexual man –, but provides multiple perspectives encompassing all the living species on Earth, fostering a shift from human-centric to life-centric design.

Fermentation: Design With Living Systems

The research aims at envisioning possible alternatives to the current industrial model for the development and diffusion of biofabricated materials, in particular of microbial nanocellulose, bypassing the long lead times which usually characterise the industrial development of new materials. Microbial nanocellulose is the by-product of the fermentation process of a symbiotic culture of bacteria and yeasts or SCOBY, traditionally used for kombucha production. Also known as “tea fungus”, kombucha is an ancient fermented tea originated in Manchuria around 220 B.C., which is today back in the spotlight thanks to its numerous beneficial properties since it acts as detoxifying agent, immune system fortifier, antimicrobial, antioxidant, and anti-carcinogenic (Dutta & Paul, 2019). Kombucha is usually obtained through fermentation of sweetened tea and the process consists in two steps: first the yeasts transform sugars into ethanol, then bacteria turn ethanol into acetic acid, releasing as by-product nanocellulose fibrils. Such nanofibrils float in the culture medium layering on its surface and bind together forming a strong three-dimensional biofilm Fig. 1. While cellulose obtained from vegetable sources requires the use of highly polluting chemicals to remove other components (lignin, hemicellulose, pectin), cellulose from bacterial sources is produced in its pure form, providing higher flexibility, hydrophilicity and drug load-release properties (Dima et al., 2017).



Fig. 1
Evolving Matter, Fermentation experiments, credits L. Trebbi 2021.

Starting from an investigation of the material on the micro-scale of processes and material properties, which resulted in a material palette illustrating the range of possibilities in terms of perceptual qualities, and identifying the material's possible application scenarios within the meso-scale of products according to the material features and identity, the research project then explored the macro-scale of production systems envisioning future prospects for development and implementation.

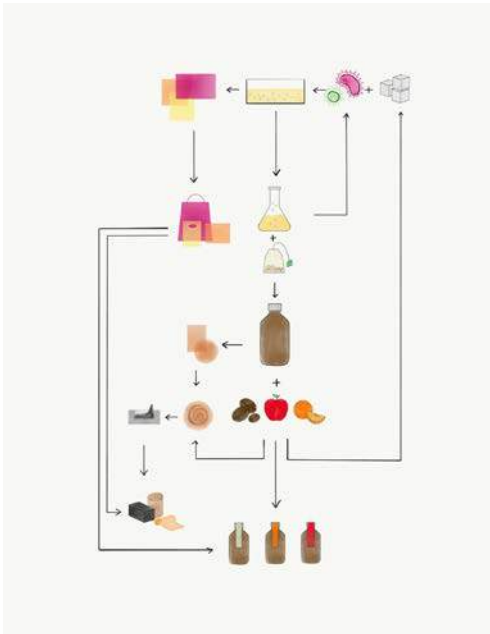
Diffuse Micro-Factory

Analysing features and peculiarities of fermentation, a diffuse micro-factory operating model has been developed: a micro-distributed production system for microbial nanocellulose fabrication and retail. The implementation of the system involved three main steps: the development of an operating model for a kombucha brewery, through which circularise the production system; the design of a fermentation toolkit to support co-design practices and replicate the model; the scaling out through involvement of local stakeholders and reevaluation of local waste streams.

A circular production system has to be necessarily grounded on the equivalence waste equals food. In this perspective, local nutrient flows need to be mapped and connected to local producers in order to develop a production system based on the SLOC scenario (Manzini, 2015), and on the model of distributed micro-production – which can favour changes in behaviours, structures and processes, and “encourages the creation of alliances, communities and movements by modifying existing power relations” (Maffei & Bianchini, 2013). The SLOC (small, local, open and connected) scenario envisions how a sustainable, networked society could take shape, starting from small collaborative initiatives and reaching large-scale effects by “replicating and connecting” to propagate and multiply the best practices, fostering the creation of connected localities and distributed systems made of a variety of interconnected elements (Manzini, 2015).

The first step was the development of a zero-waste circular operating model for a kombucha brewery, designed for microbial cellulose fabrication Fig. 2. In this perspective, a collaboration was established with an Amsterdam-based kombucha brewery aimed at completely circularise their production process reusing all the waste and by-products available, and at the same time allow the company to self-produce cellulose-based packaging and other product lines. The second step consisted in the development of a fermentation toolkit to support co-design practices Fig. 3. A toolkit is defined as “a set of tangible and intangible tools conceived and produced to make a specific task easier, so that even non-experts can do it” (Manzini, 2015). The fermentation toolkit will therefore include different tools to facilitate the implementation of the model:

- Cookbook – collecting processes, ingredients and protocols for fabrication;
- Brewing tools – containers and moulds shaped to grow the material directly in the desired shape according to its application;
- Processing tools – moulds to three-dimensionally shape the material during the drying stage, and moulds for casting nanocellulose composites.



The third and final step is aimed at multiplying the system developed in the first step with the aid of the fermentation toolkit, scaling it out, and therefore replicating the system within other contexts. Through horizontal scaling the proposed model can be expanded to other typologies of food and beverages companies, according to the kind of waste they produce – containing sugars, ethanol, tannins or other useful nutrients Fig. 4, 5. For example, by-products from beer breweries, wine producers and other alcoholic drink production, represent a valuable food source as well as any sugar source such as fruit peels from juice bars or food processing companies.

Fig. 2
Evolving Matter, Zero-waste circular operating model for a kombucha brewery, credits L. Trebbi 2021.

Hence, nutrient/waste flows characterising a specific territory will be mapped and analysed, and subsequently connected with local companies interested in selling nanocellulose-based products which, in their turn, will be selected according to the application scenarios previously identified Fig. 6.

Fig. 3
Evolving Matter, Fermentation toolkit, credits L. Trebbi 2021.

Making Is Thinking

To design with nature and living systems we need to understand its laws and learn how to manage its processes, which have always been the subject matter of science and its branches. We are now moving in a hybrid dimension in between design and science and one of designers' primary needs is to be able to fill the knowledge gap, since we are interacting with matter and processes hitherto unknown to design. We have to learn how to approach this new laboratory dimension of the project, how to co-create with living matter and develop the necessary skills to deal with the world of biofabrication. Skills can be acquired only through experience, they are “a way of dealing with things, not a derivation from theory” and



Fig. 4



Fig. 5

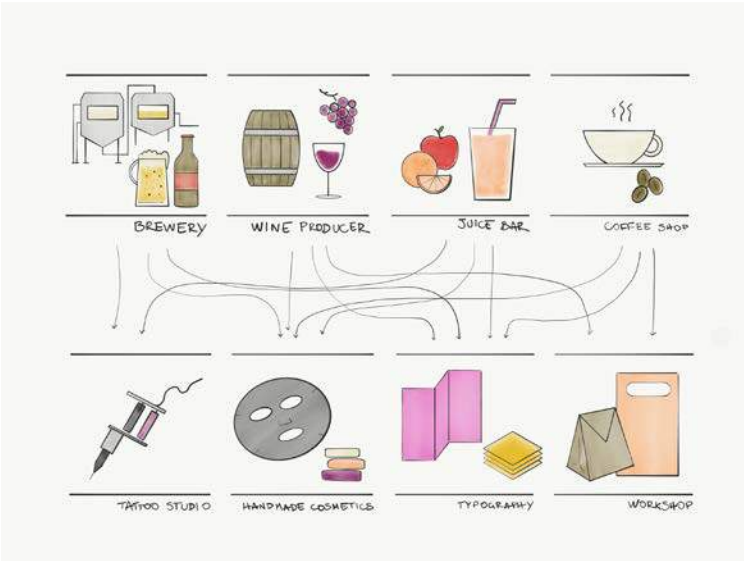


Fig. 6

Fig. 4
Evolving Matter, Fermentation experiments-coffee grounds, credits L. Trebbi 2021.

Fig. 5
Evolving Matter, Application scenario-wine bottle multi-sensory packaging from production waste, credits L. Trebbi 2021.

Fig. 6
Evolving Matter, Mapping nutrient/waste flows, credits L. Trebbi 2021.

can be improved by theory but only when theoretical knowledge is translated into habits (Bruner, 1997). The approach used emphasises the central role of experience, first-hand experimentation and craft activity within design research. Experience is a process, it represents an essential learning tool (Dewey, 1938; Fry & Kolb, 1979), it's always related to the context and therefore it's the result of specific situations, enabling us to confer a concrete dimension to theoretical research. The methodology of the research was then grounded on the principles of Action Research (Lewin, 1946; Schön, 1983), through which creating a synthesis between theoretical and practical dimension, reflection and action.

Knowing bio-materials first-hand rather than analytically through abstract information means to understand their behaviour, features and personality, to grasp their “hidden character” (Ashby, 2014) and therefore to be able to implement them into suitable products which can enhance their specificities without distorting their identity. Moreover, since operating in this new dimension where science and design merge and contaminate, acquiring methods and approaches from science is essential to properly face the world of biofabrication; however, this doesn't mean to substitute them to the ones of design, but rather to hybridise them through cross-contamination. According to Cross (1989), the main methodological difference between science and design is that while science problem-solves by analysis through problem-focused strategies, design problem-solves by synthesis through solution-focused ones. Scientists “look for underlying rules which would enable them to generate the correct, or optimum, solution”, on the other hand designers “suggest a variety of possible solutions” until they find one that is satisfactory (Cross, 1989).

Bio-designers have to be able to step outside disciplinary boundaries without however losing the specificity of their contribution in an interdisciplinary team, integrating the analytical, vertical approach of science, with the synthetic approach of design which spreads instead horizontally. This will allow to implement a systematic data collection and provide meaningful analysis while keeping the design holistic perspective and its ability to envision, synthesise and translate the result of experiments into tangible products and real-life applications. When working with living materials is then necessary to establish precise steps and defined protocols as happens for science investigation, but also to address them with a design-driven approach: guided by induction, creativity and invention. Thus, what is an error from the scientists' perspective can become a new discovery for designers, leading to unexplored paths. Designers' approach will be focused on perception, aesthetics and semantics despite maintaining scientific rigour in the experimentation, which will allow us to control and reproduce processes, but especially to acquire measurable data through which gain an understanding of processes and matter in question.

The role of designers is to envision future worlds and give such visions a tangible form through artifacts, always establishing a connection between the micro and the macro scale thanks to two essential tools: a microscope and a macroscope – “they are both needed to see things which escape our gaze: some because too big and complex, some others, on the contrary, because too small and

specific” (Manzini, 1986). In this way designers can bring scientific innovations and revolutions outside the laboratory dimension and trigger an effective impact on the real world by relating them to all other aspects – social, cultural, environmental – with which they interact, connecting the dots to make visible the overall plan (Trebbi, in press).

A Cultural Revolution

A radical shift towards circular regenerative systems seems to be the only way to go in order to not doom humanity to extinction and ecosystem collapse, learning as a species that we are part of nature and abandoning the antagonist role we played so far. The design contribution in this scenario is the ability to act as synthetic element and systematise all the aspects that intertwine in the production of artifacts: social, cultural, emotional, technical, functional, environmental. In this perspective design is characterised as connective tissue, exercising its ability to look at interconnections rather than shaping single products, acting at different scales shifting from micro to macro – from process to material, from product to system.

Distributed microproduction lays the foundation for radical changes in the production system affecting both manufacturing and distribution. It opens up new possibilities for community-based fabrication and allows the location of production facilities within the urban fabric, as opposed to the industrial model where the manufacturing sector is relegated to suburban areas (for the huge size of production structures, but especially for the polluting emissions), with all the resulting social consequences in terms of housing, “comuter towns” and neglect.

The transition towards alternative production-consumption systems, cannot be implemented by single organisations, companies nor individuals, but requires “co-operation between and across organisations and sectors” and can be put into effect only “when a number of complementary innovations occur in a parallel and interconnected way” (Social Innovation Europe, 2012). Fostering the development of distributed production systems therefore requires acting “not on the individual micro-producers, but on the tools, devices, and services that encourage their interaction in design” (Maffei & Bianchini, 2013). Moreover, through the implementation of microbial nanocellulose diffuse micro-factories, biofabricated materials can be made available through everyday products, providing an easily and rapidly accessible alternative to synthetic materials, favouring a familiarisation and demystification process towards bio-fabrication, contributing to overcome fears, closures and preconceptions which often accompany what is new and unknown (Del Gesso & Trebbi, 2019).

If we want to bring structural changes rather than just providing symptomatic solutions, we need to match the techno-scientific biofabrication revolution to a cultural revolution, integrating and hybridising the scopes of design and science (Trebbi, in press). Designers have to merge the technological dimension to the environmental and cultural ones, otherwise the risk is to repurpose a new technology with the same wrong attitude of the past, falling back into the same issues and problems of today.

Through the cultural side of the biofabrication revolution we have the opportunity to shift from an egocentric to an allocentric mindset. By moving humans from the centre to the edges (Caffo, 2017), design can become a repair tool instead of a tool for destruction and establish a symbiotic relationship with the planet grounded on mutualism and collaboration rather than parasitism and exploitation. If we can't act top-down by imposing any approach, mindset or behaviour, since we are interacting with complex interconnected systems, we can however create boundary conditions through which inducing behaviours and trigger virtuous cycles, thus affecting the socio-economic system with bottom-up practices, building from below a circular and symbiotic alternative to the current development model.

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From Sea to Fashion. Seaweeds as Material for a Sustainable Transition

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Abstract

The essay addresses the reasons why fashion design is manifesting an increasing interest in the marine environment as a context where to identify new sustainable materials for fashion, focusing on the particular case of seaweeds. Through the analysis of some significant international case studies, the recent applications of a variety of biomaterials derived from algae are observed. This phenomenon is interpreted not only as a response to the emergencies of innovation and sustainability in fashion design, but also confirms the framework of a new materialism according to a posthuman perspective. Water shifts from being perceived as a natural element exploited and polluted by fashion into a place of making kin between human and non-human through the use of seaweeds. This is possible thanks to the collaboration of design, chemistry, biology and technology, that are orchestrated to redefine the expressive codes of contemporary fashion within a multispecies landscape.

Keywords

Seaweeds

Biomaterials

New materialism

Posthuman fashion

Making kin

According to a 2017 report by the Ellen MacArthur Foundation, fashion textile industry uses approximately 93 billion cubic meters of water each year, equal to approximately 4% of the global freshwater withdrawal (Ellen MacArthur Foundation, 2017, p. 38). This data highlights how fashion generates an impact on the environment, which can be limited through the transition from linear models of production and consumption to circular and more sustainable models. An example of these attempts is the *Sustainable Textile Water Initiative (STWI)*, a multistakeholder platform for Swedish fashion brands focused on resource efficiency.²

Water has been a resource for textile manufacturing for fashion since its origins. First, artisan workshops³ then, in the nineteenth century, modern industrial production systems were in fact established in places rich in running water, necessary in the various stages of processing⁴ and to obtain the energy needed for machinery operations (A'Hearn, 1998; Fenoaltea, 2011; Basile & Ciccarelli, 2018). Since the second half of the twentieth century, the relationship between the textile industry and water has been marked by a growing awareness of the no longer sustainable impact on this resource. Concerns are due to its consistent need both for irrigation in the cultivation of fibres, and for its conversion into fabrics, as well as for the spillage of chemical substances used during the manufacturing processes and released into the aquifers (Porter et al., 1972; Ricchetti, 2017). If on the one hand the textile industry is now looking for solutions to reduce its water footprint (Hoekstra, 2008), favouring organic crops and circular production systems of traditional fibres (Aivazidou & Tsolakis, 2019), on the other hand it is showing a growing interest in experimenting with the production and use of new yarns and materials. As Badalucco and Cristofoli Ghirardello (2020, p. 30) underline, in fact, the growing sensitivity towards the theme of fashion's imprint on the environment has resulted in a renewed interest in the exploration of innovative fibres. This contribution investigates how in recent years water is not only considered a resource to be protected but is increasingly observed by fashion design as a natural environment capable of supplying biomaterials (Biofabricate & Fashion for Good, 2020); whereby seaweeds in particular have been and are being transformed into yarns and fabrics (Franzo & Moradei, 2022).

"It is indeed remarkable that a raw material, presented to us in such vast quantities, should, up to the present date, have been allowed to remain without use or application, while the 'utilisation of waste products' forms so prominent a feature": this is Wentworth L. Scott's answer to the studies conducted by Edward C. C. Stanford on the properties and potential of seaweeds in manufacturing, textiles included. It is 1862 (Stanford & Scott, 1862, p. 198) and the author's statement demonstrates how the interest in seaweeds did not originate at the beginning of the twenty-first century,⁵ but in the Victorian age. As items for collectors' classification purposes, seaweeds became a symbol of the intellectual and physical reconjunction through and with natural history. Commenting on the words of Margaret Gatty, author of *British Sea-Weeds* (1863), ecocritical researcher Stephen E. Hunt notes that this fusion of sea and nature creates a simultaneous sense of familiarity and estrangement amidst other creatures (Hunt, 2005, pp. 20-21). Hunt's reflection helps to understand the reasons for the current spread of seaweed-based materials in fashion and other design

1

The contribution is part of the work conducted at Università Iuav di Venezia by the Fashion Futuring research group, coordinated by professor Alessandra Vaccari.

2

Further information on: <https://siwi.org/sustainable-textile-water-initiative/>.

3

An example is Follina, a town in the province of Treviso (Italy), where in 1795 was established Lanificio Paoletti, a leading textile industry: the toponym derives from the fulling of the wool that spread there in the twelfth century thanks to the abundance of waterways.

4

The use of water in textile production takes place from the desizing and scouring phases, to dyeing and bleaching, unto the washing to remove chemicals, mercerization, printing or other finishings (Wang et al., 2013).

5

Stanford reports that the first patent for the use of algae in the production of fabrics was filed in 1855 by Charles Maybury Archer (Stanford & Scott, 1862, p. 188).



Fig. 1
AlgiKnit, alginate yarn
shopper



Fig. 2
Algaeing, natural pigment
Algadye 3.0



Fig. 3
Tabinotabi, dress in
seaweed fibre. Photo by
Camilla Glorioso

disciplines, which do not seem to be exclusively limited to the search for innovative and sustainable materials. Indeed, as Chiara Scarpitti writes, the increasing cooperation between the worlds of design and the natural sciences is also due to the rise of independent design practices, which on an international level have translated the utopia of transdisciplinary dialogue into a reality (2020, p. 83).

Vibrant Textiles

This contribution interprets the diffusion of seaweed biomaterials through the theory of new materialism proposed by Anneke Smelik (2018) within fashion studies. In line with the posthuman perspective that sees the interconnection between humans and non-humans (Braidotti, 2013), new materialism responds to the needs of a form of fashion where the human is decentralised. Thus, opens the horizon to the world of plants, animals and digital technologies. What posthumanism and new materialism share is, in fact, their effort to overcome dualisms. Consistently, posthuman fashion questions the notion of material agency (Smelik, 2018), engaging in the enhancement of the performative role triggered between body and dress in the process of embodiment (Smelik & Toussaint, 2016). Such are the reasons why materials made of seaweeds, plants associated with an idea of well-being and health deriving from their extensive use in cosmetics, appear to act as connectors between human body and water. This allows for the rediscovery of a renewed ecosystemic and non-binary balance. Furthermore, unlike fashion traditional materials whose imaginaries have been over time linked to fast fashion, intensive production and low sustainability, seaweeds are perceived as pristine, “vibrant”, as a living and intelligent material (Bennett, 2010).

The aquatic exploration in search of new materials to wear can be interpreted on the one hand as a metaphor for the *making kin* advocated by Haraway (2016) in the form of new alliances between biology, technology, design and the environment (Vanni et al., 2020; Payne et al., 2021), on the other hand as the effect of a multi-species contamination, in which organisms become themselves only with the assistance of other species (Tsing et al., 2015). The body, for the most part composed of water, is transformed into a support on which seaweed-based garments come back to life. As a consequence, seaweeds represent the raw material to build new aesthetics and communicative imaginaries through tangible experiences.

From Seaweeds to Biomaterials

This contribution focuses on the transformation of the seaweed plant into yarn, fabrics, garments and accessories, analysing some international case studies that demonstrate how the theory of a new materialism can be applied to develop a posthuman perspective in fashion. Committed to bringing matter and body experience back to the centre of the debate, posthuman fashion weaves a multitude of inedited interconnections within the living world. Seaweeds are biomasses that grow in the ocean waters of the world; the type mainly used is the Kelp algae native to the Icelandic fjords. They do not contain fibres ready for textile spinning, though the yarns are made with cellulosic fibres manufactured by incorporating a small amount of dried and ground into powder seaweed material (Bak et al, 2019).

Among the brands involved in the making kin is AlgiKnit, an American start-up born in 2016 as part of the *Bio Design Challenge* of the FIT in New York. AlgiKnit creates resistant but biodegradable yarns with Kelp seaweed Fig. 1. The alginate of the algae is pulverised and transformed into a water-based gel to which natural dyes are added, to lastly be extruded into long strands according to a technique already described in the 1940s (Delf, 1943, p. 152). As stated by the brand, science and design come together in this project to combat climate change, encouraging a closed-cycle and low-impact textile industry. "In materials science we are now finding more inspiration in nature," says Schiros (Cirino, 2018), one of the founders of the project and associate professor at FIT where she experiments on new materials for fashion (Schiros et al., 2021). Another patent for the transformation of seaweeds into yarn is of the Austrian company Lenzing, whose SeaCell fibre is obtained by incorporating the brown seaweed *Ascophyllum nodosum* collected in the Icelandic fjords, dehydrated and pulverised, in a natural cellulose fibre obtained from beech. However, it must be noted that from the product technical data sheets the percentage of seaweed still appears very low, justified to allow adequate and persistent technical performance (Fangueiro et al., 2014, p. 248). Similar is the process adopted by the Israeli start-up Algaeing founded by Renana Krebs, which is developing two products with algae: either combined with cellulose to obtain a natural and biodegradable fibre, or transformed into the natural dye Algadye 3.0 Fig. 2.

The use of seaweed-based yarns and fabrics is increasingly diffused in the collections of global brands, both high-end and fast fashion (Bittau, 2021). Even if in some cases these actions seem to respond more to communication and marketing needs, interpretable as greenwashing strategies, other experiences demonstrate the real potential of such materials for clothes and accessories design by stimulating fertile connections with specific or local contexts. In this direction a significant case is Tabinotabi Fig. 3, an independent brand born in Venice in 2018 with the aim of using exclusively seaweed fabric. Tabinotabi demonstrates how fashion is capable of inventing imaginaries starting from the criticalities of a context. As evidence, the apparition of seaweed clothes in the shop windows near the Rialto bridge that recalls the literary metaphor of Venice, which nonetheless also denounces its current invasion that represents a problem for the lagoon. During an interview,⁶ the founder Alessandra Defranza declares that customers and tourists are particularly intrigued by the process that transforms seaweed into a wearable garment, and immediately try to carefully grasp its visual, tactile and olfactory characteristics (Vaccari & Franzo, 2021, p. 78). Seaweed are also protagonists in the high-tech pieces conceived by the brand Vollebak. Among others, it has created a compostable t-shirt to be buried in the garden at the end of its life, where it biodegrades in 8-12 weeks based on temperature and humidity fig. 04. In line with the brand's approach to an artificialization of nature, the t-shirt is composed of eucalyptus and beech pulp fibres, mixed with algae grown in a laboratory inside bioreactors. The t-shirt is printed with green ink based on spirulina algae, a natural pigment that oxidises and fades with air, inviting the customer to take care of the garment as if it were a living being. Care is also at the core of Biogarmentry non-woven fabric designed by Roya Aghighi in collaboration with AMPEL Lab and the Botany Lab of the University of British Columbia. Inspired by the challenge of providing survival to photosynthetic cells of algal origin on cellulose and proteins-based fabrics, these *living clothes* are activated in the sun and are a literal



Fig. 4
Vollebak, biodegradation
of the Plant and Algae
t-shirt



Fig. 5
Biogarmentry, living
clothes



Fig. 6
Daniel Elkayam x Nat-2,
algae sneakers

invitation to take care of the personal wardrobe fig. 05. The last case is Nat-2, a sustainable sneakers brand that has experimented with the use of a semi-transparent material based on algae for the capsule collection in collaboration with the Israeli designer Daniel Elkayam fig. 06. Inspired by biophilic values, the line was born as a continuation of the designer's *SEAmathy* project, which experiments and reflects on the life and death of organic matter – specifically algae. The focus is on the transition of the plant from the natural habitat to the role it assumes as a support for fashion activating a new life cycle.

Wearing Seaweeds

The cited case studies illustrate fashion experimentations applying seaweeds that are nurturing research practices intertwining design and science. Unlike traditional vegetal fibres, such as cotton and linen, seaweeds are characterised not only for evoking an exotic and yet unfamiliar imaginary, but also a low-impact production system: they are abundant in nature; they do not require irrigation; only their regenerative part is being used; they do not consume arable land neither require pesticides or fertilisers; they biodegrade quickly; they are naturally fire resistant reducing the need to add toxic flame retardants to clothing; they are processed in plants already oriented towards energy optimization (Bak et al., 2019). However, the possible criticalities of seaweed application should not be overlooked. For example the emissions and costs related to transport, since most of the production is located in Iceland. As well as the loss of centrality of territories historically used for the cultivation of traditional fibres. Nonetheless the risks of a colonisation of new marine areas for the development of intensive cultivation of seaweeds with possible future imbalances for the ecosystem. This essay does not consider algae-based materials exclusively as environmental alternatives for sustainable practices, but rather addresses these plants as a means for establishing possible connections between human and non-human. They are “vibrant”, alive materials that evolve over time and which require care. They redefine the concepts and temporalities of fabric and fashion. This is encouraged by the intrinsic properties of the fibre that generates an effect of physical well-being, keeping its characteristics unaltered along the transformation process. Even after several washing cycles, the seaweed fibre is able to activate cell regeneration and reduce skin inflammation thanks to the active ingredients of the sea like amino acids, iodine and mineral salts⁷.

By applying a plant metaphor to fashion (Moradei, 2022 in press), seaweeds transformed into fabric and placed next to the human body seem to reconfigure a new natural environment. Thus, they symbolically resume life in a multispecies landscape, representing a possibility of progressive change in the relationship between humans and the planet.

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These reasons are the basis of the initial success of this product for textile application in the medical field (Janarthanan & Senthil Kumar, 2017).

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The Sound of Sustainability. Biomaterials and New Sensory Frontiers

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Abstract

Sound is an inescapable part of perceptual experience and, interacting with other senses contributes to the synesthetic experience. The article investigates the possibilities that Design research can offer from the consistent use of new materials in terms of *sensory enhancement* and the construction of a *memory identity*. The sensoraesthetic qualities of these open up new *worlds of senses*. New biomaterials, in addition to guiding the development of a new sensitivity and towards the acceptance of the material's sincere identity, can help to communicate a new ethical consciousness, transforming sustainability into responsibility, i.e. into a dimension involving not only the objective aspects of matter but also the subjective ones based on pleasantness. The ultimate goal is the construction of a *sensory polyphony*. A new field of exploration that is recounted here through a design experience developed at Saperi&Co. for the realisation of drumsticks made from discarded peanut shells.

Keywords

Material driven design
Material design experience
Sound experience
Product sound design
Material tinkering

Sustainability and Design

Sustainability is an imperative that over the years has involved design at different levels, progressively asking it to communicate its value to establish an ethical attitude towards the Environment in the common consciousness. By Environment we refer to both the physical and socio-cultural surroundings according to the integral definition of Maldonado (1970), manifesting an awareness of the indissoluble link between anthropic and non-anthropoc components. Therefore, as Jégou and Manzini (2003) state, the transition towards sustainability is first and foremost a process of ethical and social learning, for new ways of living better, consuming less and regenerating nature and things. By applying systems thinking, it is, therefore, possible to amplify the reference to the structural principles of natural ecosystems. Already Papanek (1971) was proposing a redefinition of product design in ethical terms by devoting himself to the 'biological principle of minimum effort', according to which the maximum variety should be obtained with the minimum of inventions, by recycling and reusing materials.

An approach that has evolved to the present day, passing through the watchwords of reparability, regeneration, but also eco-innovation; towards a more systemic and all-encompassing 'cradle-to-cradle' vision, which assimilates the industrial system to the biological cycles of production and consumption, elevating reuse and reintroduction practices to industrial scalability and production optimisation (McDonough & Braungart, 2002).

The focus shifts from the product and the simple application of sustainable technologies and materials to these to a radical and systemic innovation that takes into account the entire context with which these products are related, made up of people, behaviours, processes, values, mutual relations and material flows. In this sense, Design becomes a lens through which to analyse and address reality, a conceptual bridge between skills, industry and society, and an engine for new, more responsible and shared scenarios (Lucibello & La Rocca, 2015).

In this perspective, the union between design and research on materials is particularly active and fruitful: they do not simply represent the physical interface of production, and therefore the tangible weight in terms of consumption of primary resources (Pellizzari & Genovesi, 2017), but are also a point of discussion for reflecting on the way and the world we live in.

Materials in Design

In the development of design research on materials, the limits of classification systems emerged, which exclusively considered transformation processes and physical-chemical and mechanical characteristics. These proved to be insufficient concerning the variety of aesthetic-sensory attributes offered by the new materials (Manzini, 1986), which played an increasingly important role in the design activity for defining the experience with artefacts, in sensory involvement. They are linked to style and symbolic associations, contribute to generating pleasure and give a product its personality (Ashby &

Johnson, 2013). The focus on materials has led to the emergence of materials libraries, physical and virtual places where designers can come into contact with materials. This database of knowledge, previously collected in catalogues, books and publications, has, since 1997, with the birth of Material Connection, begun to take possession of physical places where Designers can experience their properties. These continually developing research centres represent a potential hub for creative activity and, in addition to containing the set of characteristics relating to the structure and behaviour of materials, they represent the body of multidisciplinary knowledge related to them.

These continuously developing research centres represent a potential hub for creative activity and, in addition to containing the set of characteristics relating to the structure and behaviour of materials, they represent the set of multidisciplinary knowledge related to them. They represent the natural meeting point between the materials science community and the design community, which normally move in separate academic and social environments. Here, synergetic relationships can be established in which designers disseminate research results through the application of materials to everyday artefacts. Purposes that are not traditionally the focus of materials researchers.

Design in Materials

With the advent of bottom-up phenomena such as the maker revolution, design has entered the gap between materials research and their applications. DIY-M (Do It Your Own Materials) represented an evolution in the discipline where experimentation with materials became a guided research practice (Rognoli et al., 2016). The designer relates to the project in a new, direct and empirical way, based on interdisciplinary cooperation and the exploration of alternative paths that make creativity the tool for disruptive innovations and materials the instrument to characterise the project. This opens up a new opportunity to continue investigating the nature-artifice relationship and the themes of sustainability, this time through natural, renewable, recycled, recodified and ennobled materials. Designers participate in the design phase of materials by contributing to the redevelopment of their semiotic environment, their recognisability and their meaning (Ceppi, 2016). They intervene upstream by reinventing through creative processes and *disruptive* and regenerative forms of industrialisation, through autarkic materials (Finessi, 2014) and transferring new materials that have no application. Downstream, by giving identity to new materials through applications of meaning.

Material Experience / Sound Experience

Starting from direct manipulation and physical-sensory exploration of the intrinsic and extrinsic qualities of matter, we can thus define a world of sensory and emotional references for artefacts. The 'material experience' represents precisely the user's experience when interacting sensorially with the product through and because of the materials used (Karana et al., 2014). In designing this experience, not all senses have received equal attention. In particular, sound is

a frontier that is still little explored, both in its performative and playful valences (Del Curto et al., 2010). Attention has been paid to it much more frequently out of necessity (elimination of unwanted noise) rather than to enrich and characterise the sensory experience.

However, in the contemporary process of dematerialisation, it increasingly represents an important memory identity factor. This is why it is receiving increasing attention as a tool to implement and enrich the experience, in response to an increasingly complex reality. According to Lenzi et al. (2022), research areas that are contributing to an increased focus on sound in the field include Sonic Interaction Design, Auditory Display and Data Sonification, Sound branding and Sonic information design. Özcan & van Egmond (2008) define Product Sound Design as a way of approaching design in an interdisciplinary way, dialoguing with Acoustics, Engineering and Psychology. Designing the sound of a product, and associating a pleasant sound with an inert material, represents a new way of exploring the frontiers of polysensoriality, moving from listening to the sound of materials to giving them a voice.

Methodology

The exploration of the synaesthetic value of biomaterials in the field of sound required the definition of a specific, deductive methodology based on Material Design Driven (Karana et al., 2015).

The experiment was carried out at Saperi&Co., the research and service centre of Sapienza University of Rome, involving a multidisciplinary team.

The research methodology adopted - with the material at the centre - was organised in 4 main phases:

- 1 Knowing (through research and selection of secondary raw materials).
 - Analysis: selection and study of food industry waste for the identification of possible secondary raw materials to be used as biomass for the development of new materials.
- 2 Understanding (through Material Experience).
 - *Material Tinkering*: development of samples from recipes and data on do-it-yourself materials available on open-source platforms (Materiom). Experiential survey to assess the quality of sensory perceptions through evaluation on a scale of -5 to 5, interviews and direct observation.
- 3 Know-how (through consistent application of material into a product).
 - Prototyping.
- 4 Testing (through aesthetic-perceptual and technical-scientific analysis).
 - Qualitative evaluation: evaluation of the user experience and sound perception of the prototype compared to wooden drumsticks.
 - Quantitative evaluation: Evaluation of the acoustic properties of *Peanut Butteria Sticks (PBS)* and comparison with wooden sticks using the method used by Laughlin et al. (2008).
 - Expert evaluation.

Qualitative evaluations were carried out on a sample consisted of 30 users, 12 women and 18 men of 6 different nationalities.

Case History: *Peanut Butteria Sticks*

With the use of secondary raw materials as a premise, our attention turned to the waste, particularly the shell, of common peanuts. The choice was determined not only by the material's own characteristics - composite, woody, mouldable and self-hardening in nature - but also by its sensorial prerogatives that make it a material experience to smell, look at and touch.

The idea was to remove this material - commonly destined for incinerators — from the logic of disposal, charging it with a *principle of continuity* underlying the entire process from raw material to finished object. The shells, composed of cellulose and lignin (Bharthare et al, 2014; Bobet et al, 2020; Quaranta et al., 2018) exactly like the bark of trees, are therefore ideally a material extension of the tree itself. The manufacturing process identified follows very precise stages. Through consultation with Materiom — a digital platform run by a non-profit organisation working at the intersection of design, digital fabrication and material science — an attempt was made to identify 'recipes' using peanut shells to begin the Material Tinkering process.

The shells were kneaded by hand, using a binder-free of toxic substances, solvents and formaldehyde, or combined with different binders and additives: water, glycerol, vinegar and potato starch in different ratios. Different shell grain sizes were tested to experiment with different visual and tactile possibilities, but also to provide different levels of strength. It was possible to realise different colour gradients in the samples by varying the amount of inner and outer shells Fig. 1. As it is a self-hardening material, after being kneaded, it is poured into moulds designed and made from natural filaments using 3D printers. This results in a more or less porous material depending on the grain size of the shells and the type of polishing.



The learning process of material qualities continued even after the samples were made to evaluate possible treatments (colouring, texturing) and the material's resistance (to fire, water, pressure, impact). These analyses again triggered the iterative process that returned

Fig. 1
G. Inglese, Peanut Butteria Stick, Colour variation of samples, credits G. Inglese 2022.

to the development of the material by reviewing, in an experiential learning approach, shapes, dimensions, type and ratio of ingredients, process time and temperature. Through benchmarking, the material was placed among similar materials to generate insights into potential areas of application. These were identified based on selection by synthesis, i.e. the combination of selection by analysis (study of the literature to understand the material's specific technical composition) with selection by analogy (in which the material's attributes were compared with those of possible alternatives and substituted for preconceived notions or simple experimentation) (Lucibello, 2005). At the same time, samples of various shapes were submitted to users for a perceptual evaluation of the material. According to an average of the evaluations, the characteristics with the highest scores were hardness (3), texture under the tactile and visual aspect (3) and sound (4). The worst ones were related to taste (-3) and smell (-2). The observation of the interrelationships between the expected and observed experiences and the formal properties of the samples showed that some of the samples were often considered 'natural' and 'cheap', but especially in the lighter and more elongated samples a 'resemblance to wood' was recognised. In order to compare the data for the different samples, they were compiled on a Cartesian diagram (based on the model of Mike Ashby's CES) in which the ordinates showed the pleasantness rating while the abscissae showed the performance rating on a 10-value scale (-5 to +5) Fig. 2. To these were added the considerations developed in the tinkering phase. All this guided the selection of the most promising samples (and recipes), to transfer the interrelationships between performance, meaning, and sensory qualities detected in the material to subsequent product development.

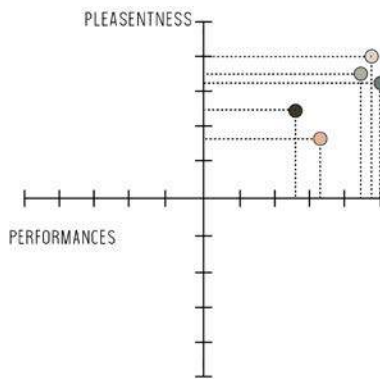


Fig. 2
G. Inglese, Peanut Butteria Stick, Example of diagram for evaluating the pleasantness and performance of samples, credits G. Inglese 2022.

The choice of the application of the material for the manufacture of drumsticks was motivated not only by the connection to the noble material (which has long been used in the construction of musical instruments for its acoustic performance) but also by considerations regarding the state of the art. The intention was to bring a new contribution in the application of biomaterials to the audio field where the perceptive aspect, the sincere identity of new materials, is currently not emphasised. Drum sticks seemed the natural application for the material which:

- presented excellent qualities in terms of tactile, visual and acoustic senses;
- was combined with wood from a technical but also associative point of view;
- allowed for processing by moulding.

The tinkering process was resumed to further optimise the material for processing, to meet performance requirements and to implement the sensory experience of the product. *PBS* Fig. 3 were produced through moulds made based on the wooden sticks used for the subsequent comparison in order to assess the acoustic properties by keeping the shape constant and only varying the material. The main factors influencing sound production are in fact shape and material (density and elastic modulus).

Fig. 3
G. Inglese, Peanut Butteria Stick, Representative image, credits G. Inglese 2022.



The two different types of sticks were supplied to the selected sample of users to qualitatively assess their sound experience. In the choice of different terms to define the acoustic attributes of the materials according to the list compiled by Ashby & Johnson (2013), the sound of the *PBS* was found to be more 'muffled', 'dull', and 'low pitched' than the wooden ones.

The quantitative evaluation of the acoustic characteristics was carried out by recording the two drumsticks striking each other through a microphone connected to a sound card. The recordings were normalised and subsequently analysed through the use of Matlab software under the supervision of Sound Engineer Giovanni Inglese. The study of the sound damping level showed that *PBS* had a lower amplitude ratio, being more damped than those wooden, confirming what was perceived by the sample. This behaviour was confirmed by the fact that peanut husks have a very good sound absorption coefficient (Jang, 2022) and therefore find application in the production of green sound-absorbing materials. In contrast, analysis of the frequency spectrum showed that they had a higher frequency fundamental Fig. 4, in contrast to the qualitative assessments that considered them to be more low-pitched.

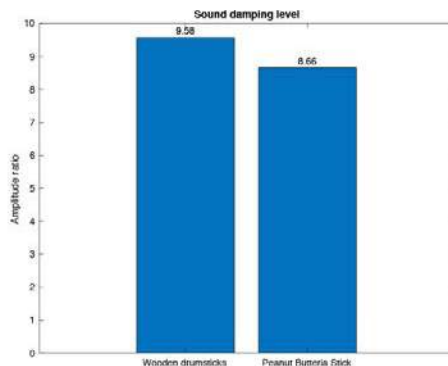
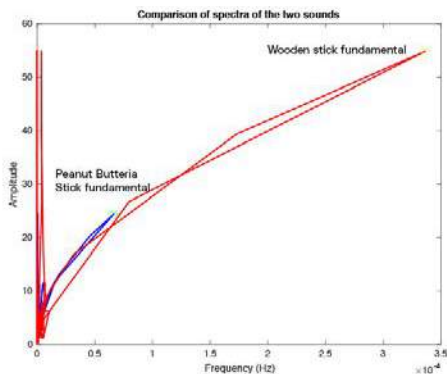


Fig. 4 G. Inglese, Peanut Butteria Stick, Comparison of spectra and damping level of the sound of the two drumsticks, credits G. Inglese 2022.

Finally, *PBS* were submitted for evaluation by Andrea Santarsiere, a percussionist at the Accademia Nazionale di Santa Cecilia and a member of the Orchestra Giovanile Italiana (2001-2002) and Orchestra Giovanile Europea (2002-2003). He stated that ‘although they present interesting features at this stage of development, they are not usable at a professional level. Rather, they could, with due improvements, prove to be excellent tools in teaching: they could replace drumsticks training and mutes’.

Previous experiments have already attempted to explore the application of biomaterials in the audio field. Silver Mountain used a hemp-based material, which appears to be an excellent substitute for plastic due to its excellent properties, for the production of guitars, ukuleles, speakers and other accessories. Tecnaro used Arboform, a natural polymer with the same properties as wood but which can be processed like plastic, to produce loudspeakers and flutes. In both examples, the materials used simply substituted those traditionally used in industrial production, with little regard for their sensoaesthetic properties.

In our experiment, the comparison between the data obtained in the qualitative and quantitative analysis was particularly interesting: whether or not they matched up reveals the many possibilities of research in this field. We have limited ourselves to analysing the general behaviour of the sticks and when they strike each other to simplify experimentation and not to involve the effect of other materials in the measurements. Subsequent additions may concern the behaviour of the sticks when they strike other drum components such as the snare (leather) or hat (metal). Further experiments on the effect of materiality on the sound may instead concern the shape of the sticks or changes to the recipe. In the application of new materials to specific contexts of use, dialogue with practitioners in the field is important, from whom important feedback can be received to implement testing. In our case, the use of *PBS* in the field of education as a replacement for training rods or mutes was pointed out to us, due to their acoustic characteristics: the new material could represent an alternative to the plastic from which these are commonly made. This dialogue is crucial if we hope to truly design innovative instruments that open up experimentation. The exploratory terrain of sound and musical instrument design represents the ultimate expression of a civilisation’s materials and technologies

(Pinch & Trocco, 2004). As in the silicon age (Miodownik, 2007) where the production of electronic components led to synthesisers and electronic sounds that characterised the sensory experience of our everyday life. Musical sounds are not exhaustive of the wide range of sounds we normally listen to: most everyday sounds and their cultural resonances are the product of the materiality of the artefacts that surround us, of the dialectical relationship of sound with physical objects (Hug, 2008), thus largely the result of the practice of Design. If in defining the idea of a sustainable future the visions of this scenario are already quite clear to most, it is still difficult to hear the sound. 'Hearing modernity' must mean bringing out the social, cultural, economic, political and affective stakes involved in sound technologies, and we are still in the early stages of this project (Pinch, 2019). Materials research can provide an opportunity to design 'everyday listening' (Gaver, 1993), helping us to preserve or even improve our Environment.

Conclusion

In the current panorama of research on materials, designers are confronted by the sensoaesthetic potential offered by biomaterials. In addition to providing a sustainable alternative to traditionally used materials, whose production or disposal processes are particularly *unsustainable*, they are opening up the field to new scenarios and unprecedented expressive possibilities, also concerning the auditory sphere. The use of biomaterial, removes the material from the logic of waste, establishing with the starting material, a relationship of *continuity* that extends to the entire process (from the raw material to the finished object).

The decision to use waste peanut shells, which are also composed of lignin just like tree bark, ideally places us in a relationship of material extension to the tree itself. From the sourcing of the raw (and second) material to its processing, the process described here involves a sustainable supply chain in which the material comes to shape the identity of the final object. *PBS's* experience, in its simplicity and narrowness, thus recounts a possible approach to the reuse of waste as a basis for building new materials through a *circular* route. It intends to manifest that the impact of new materials can go beyond their molecular structure, becoming in the hands of Design a tool to enrich our everyday listening: through artefacts capable of communicating different worlds of senses, education, meaning and hierarchical organisation of the same, one can make the culture of one's time perceptible.

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Unpacking Ceramic History in Asia and Europe: Contribution to New Reusable Packaging Design

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Abstract

Written within the scope of a PhD research project that is being developed at the University of Aveiro (Portugal), this article is based on research for design, through design. The goal is to develop a proposal for a non-disposable modular packaging system for ceramic products, which can organize interior spaces, thus reducing waste. Its development relies on the partnerships of two companies in the distinctive areas of ceramics and textiles, namely: Grestel-Produtos Cerâmicos S.A. and Tintex Textiles S.A.

A historical study of ceramic ware packaging was developed through a documental analysis of relevant moments of long-distance transport history, before disposable consumption habits. By gathering and analysing information that provides significant contributions based on historical facts, this study targeting a contemporary solution for a reusable packaging project.

A proposal for a modular packaging system has already been designed and validated by the partner companies.

Keywords

Reusable packaging
Design
Ceramic history
Project
Sustainability

Introduction

According to Eurostat (2022), as world consumption increases, it seems that the need to produce packaging for different goods and products represents an increase in the use of resources and consequent waste, due to a markedly disposable habit of human consumption. For Kedzierski *et al.* (2020) this phenomenon occurs in a particular context of Human history: the consumption society. Intensive and combined with an insufficient percentage of reuse and recycling, it is a source of pollution, being evidence of the lack of social and environmental impact concern that this type of behaviour and management causes.

Since the second half of the 20th century, plastic has become economical enough to be used in packaging due to material innovations and to “the very idea of its infinite transformation. As its vulgar name indicates, it is ubiquity made visible” (Barthes, 1957, p.97). Thus, older materials were replaced, inaugurating a new type of disposable consumption baptized by Papanek (1973) as “Kleenex Culture”.

As for packaging, large quantities end up not entering the waste management system, losing their material value to the economy (TU Delft OCW, n.d.). The linear model “take-make-waste” facilitates the destruction of the packaging material [and symbolic] value, promoting the perpetuation of a disposable consumption habit (EMF, 2021).

“Cultural and historical awareness are woven into the DNA of any worthwhile product” (Jongerius & Schouwenberg, n.d., p.1), in line with the valorisation of the artefact as the perpetuation of memory and identity. It is from this genetic code that the exercise of Design configures a strategic process of redesign, from which the *curative* action turns the solution more sustainable, or any other requirement to fulfil (Latour, 2008).

Packaging should be considered a product with its own right and life cycle (Vezzoli & Manzini, 2008), and design should assume a leading position in creating value, and not just as a means of solving problems (Ito, n.d.).

By building a modular and durable packaging system for ceramic products, aiming at its maintenance and longevity, continuous reuse, and the enduring possibility of repair, furthermore integrating waste from ceramic production itself, this research project’s ultimate goal is to reduce disposability and waste. For this purpose, the historical study of packaging for ceramic ware before disposable consumption constitutes a relevant tool for design.

Structure and Methodology

This article is divided into five sections: 1) introduction to the relevance of the issue of this article; 2) structure and methodology; 3) document analysis on the history of packaging for ceramic ware before disposable consumption; 4) presentation of the ongoing research project; 5) discussion and final remarks.

The document analysis intends to identify how ceramics were packed and transported in specific historical moments over

great distances: the first direct sea trade between Southeast Asian countries and China; the intense commercial (and cultural) exchange between Asia and Europe; the European decline of Asian ceramics import; the fleeing journey that preserved the Forbidden City's ancient treasures.

The research project undergoes by designing a modular and durable packaging system for ceramic ware. The materials selection considers local resources, lightweight recyclable materials, and the exploitation of waste and byproducts in a new textile material.

After prototyping, the research partners validated the project.

Unpacking History (Before Disposability)

For thousands of years, ceramic products have been transported and traded over long distances. As Twede (2002; 2016) states, the large clay amphorae that transported wine, olive oil, and other food products were used throughout the Mediterranean world by the ancient Egyptians, Greeks, and Romans as reusable containers due to their great sturdiness and durability.

In Asia, ceramic ware, manufactured in stoneware or porcelain were, in addition to domestic consumption, produced for commercial trade between distant markets (Witkowski, 2016).

Packaging and the First Direct Sea Trade Between Southeast Asian Countries and China

In recent decades, the discovery of ancient shipwrecks in Southeast Asian waters has exposed new opportunities for the study of maritime trade and its cargoes (Fan & Li, 2021; Guy, 2019), which allows for unprecedented readings about packaging. During the 7th century and the first half of the 8th century, contact between China and Western Asia was intensified, with the consequent increase in cultural exchange and commercial trade, which shifted from the land Silk Road to the maritime Spice Route (Raby, 2011).

As Worrall (2009) mentions, ceramics also became very popular and land transport assisted by camels turned out to be a bad strategy as it did not guarantee the integrity of the products: rising quantities of ceramic ware began to be traded by Persian Gulf merchants.

According to Flecker (2010), the first material evidence of maritime trade between Southeast Asia and China is the shipwreck Belitung, sunk in Indonesia in the 9th century, which contained, among other types of ceramic ware, stacked bowls placed in the hull adjacent to the roof beams, presumably in straw "cylinders".

Zhu Yu, who portrays various maritime events, describes how ceramic ware was packed in Canton, in a similar method used in the 9th-century vessels.

Fig. 1
Raquel Gomes. Small
stacked bowls inside a
large jar. China ink on
paper, after photo from
Michael Flecker, 2010.



“The greater part of the cargo consists of pottery, the small pieces packed in the larger, till there is not a crevice left” (*apud* Hirth & Rockhill, 1911, p. 31). Also, Worrall (2009) shows that the tall stoneware jars served as containers and could hold more than one hundred bowls which, presumably, would be padded with rice straw.

Packaging between Asia and Europe

However, with the arrival of the first Europeans at the ports of Asia, cultural exchange and trade were intensified as never before (Ketel, 2021). As Liu (2016) mentions, porcelain was the main cargo, promoting a system of transcontinental and transoceanic trade, and giving rise to the so-called global trade.

On the other hand, some authors argue that the large quantities of porcelain were mainly due to the need to create ballast to maintain the stability of vessels. They were not considered a main commodity until about 1600, but as an added business opportunity, since the big profits were obtained from spices, silk, cotton, and tea trade (de Hullu, 1915; Giehler, 2020; Witkowski, 2016).

In the late 1500s and early 1600s, porcelain was transported in wooden cases, filled with rice and water and placed in a damp place to form a solid mass that would adhere to the ceramic items, creating a compact and unbreakable block (Mann, 2011).

Like the jars used in previous centuries, the martabans – tall stoneware pots with an ovoid shape, coated with thick glaze (Mateus *et al.*, 2017), used to transport foodstuffs and small items of porcelain – were wrapped in coir or sisal netting, cushioning, and turning them

easier to transport with bamboo canes (Loureiro, 2010). As mentioned by Loureiro (2010), teapots, vases, or censers of greater value, could be stored in smaller boxes, adopting partially or completely the shape of the piece they were storing.



Fig. 2
Raquel Gomes. The arriving of Portuguese to Nagasaki with boxes of porcelain. China ink on paper, after Namban screen from MNAA.

For the same author, presentation was also very important since it would contribute to the valorisation of the cargoes. Also, both China and Japan had a great tradition in the art of packaging, confirming its relevance whenever there was a need to export goods of greater material or symbolic value (Loureiro, 2010).

Packaging and the European Decline of Asian Ceramics Trade

From the first quarter of the 18th century forward, with the growing demand for tea in Europe, the Chinese porcelain market began to adapt to this new taste: cups and saucers became dominant in the cargoes (Giehler, 2020). It is shown in gouache illustrations from that period that, at least in the first quarter of the 19th century, porcelains were padded with tea leaves.



Fig. 3
Raquel Gomes. Packing the Porcelain with tea leaves in wooden cases. China ink on paper, after Packing the Porcelain in crates, Peabody Essex Museum. (Kay, 2011).

As Giehler (2020) states, with high import taxes and increasingly fierce competition from European porcelain manufacturers who, meanwhile, have acquired the knowledge to produce it, trade between China and Europe had fallen into decline. The production of copies of blue and white porcelain began in Delft and until the end of the 18th century almost all the East India Companies stopped importing porcelain.

Packaging and the Fleeing Journey of the Ancient Treasures From the Forbidden City

Of a non-commercial nature, but quite relevant to this study, was the transport of ancient treasures from the Forbidden City during the period of wars in China. According to Arranz (2018), when Japan invaded Manchuria in 1931, several artefacts from the Palace Museum of Beijing were removed in an attempt to protect the historical legacy. The collection built over centuries, which included ceramic items of great value, among objects of other nature, was packed in 19,557 wooden crates and travelled around 75,000 km over 14 years.



Fig. 4
Raquel Gomes. Artefacts from the Palace Museum are packed in crates. China ink on paper, after photo from Beijing Review, 1933.

The packaging process for each artefact was divided into four steps: 1) layers of wet paper were placed around the object until it reached half its thickness, 2) hemp ropes were tied tightly, 3) layers of cotton were wrapped, 4) the object was placed inside each wooden crate filled with rice straw and cotton (Arranz, 2018).

Regarding porcelain plates, as described by Wei (2020), the edges were wrapped in cotton, then piled up and tied with rope. Finally, each pile was wrapped in paper and separated from one another with cotton or straw.

In 1947, when the collection was finally (partially) assembled, no objects were damaged (Wang, 1985).

The history of packaging reveals crucial knowledge for design to respond to current challenges, as Twede (2016) states, “this is a story of innovation and adaptation that offers, in itself, a visible path to its future” (p. 127). The *evolution* towards disposability and consequent waste also brought awareness of the need for a paradigm shift, both in terms of sustainable production and consump-

tion habits, offering a field of reflection and research where design can and should operate. As Schumpeter (1954; 2012) sustained, innovation means and implies that new products, ways of production, resources, markets, and business models are combined, from existing resources, in a new way.

The Project: Grestel Reusable Packaging

The ongoing project aims to build a modular and durable packaging system for ceramic ware, designed for its maintenance and longevity, continued reuse, and the possibility of repair, whenever necessary.

The research relies on the partnership of two Portuguese companies: Grestel, Produtos Cerâmicos S.A., located in Vagos, which creates and produces fine stoneware tableware from local resources and with a percentage of production for the export market above 90% namely, European, North American and Asian; also, Tintex Textiles S.A., located in Vila Nova de Cerveira, operates in the textile industry and is a market leader in circular knits and a world specialist in dyeing and finishing processes.

Using a type of local engineered wood, with the benefit of a lower carbon footprint in its transport, recurrently used in the region of Aveiro (Portugal), poplar plywood has low density, is light weighted, and has the ability, at the end of its life cycle, to be recycled or used for energy (ProPopulus Team, 2022). Likewise, waste and by-products are used, according to the Circular Economy principles (EMF, n.d.), from the ceramic production of Grestel, resulting in a new textile product to be incorporated into the packaging.

From the introduced waste, as a result of this research, Tintex Textiles produced a new product as a substitute for animal leather, with a good performance in terms of mechanical resistance, abrasion, and humidity and, therefore, exploiting its residual value.

This product, in different colours, already prototyped, will promote a personalization experience: the pleasure of this type of experience and the emotional connection to the product lead to its longevity, as Norman (2004) states.

For the modular system and as a matrix, a tray with a perforated base was designed: from the placement and organization of the various ceramic items, we defined the design of each configuration and proceeded to their superposition. This process made it possible to obtain a cutting pattern that represents the summary of all configurations.

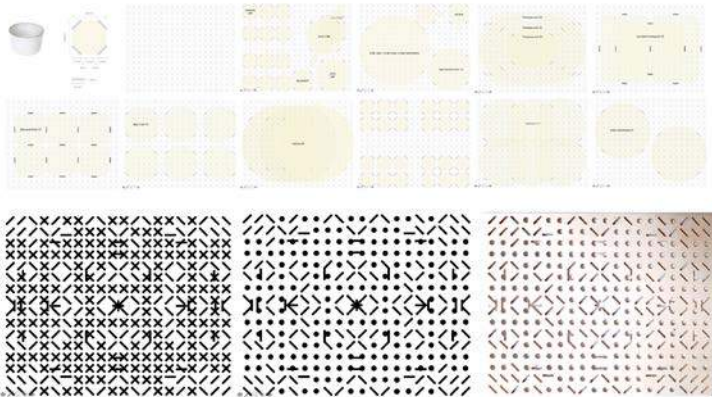


Fig. 5
Raquel Gomes. Study
for cutting pattern.

For different groups of ceramic items, with different heights, three boxes were designed: small, medium and large, which can be interconnected becoming a modular system for organizing interior

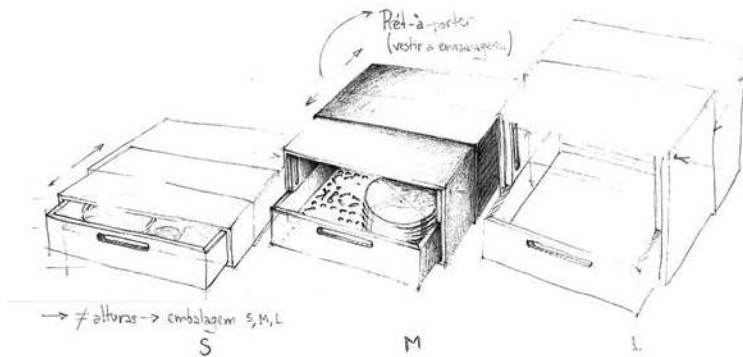


Fig. 6
Raquel Gomes. Drawing
of 3 different sizes (pack-
aging).

spaces.

This type of packaging can be shipped and delivered without needing a secondary packaging.

Once at home, packaging can be opened and “dressed” in the textile product. The packaging/module is ready to become a cabinet, a storage unit, a hanging shelf, or any other configuration adaptable to the taste or need of the final consumer.

Discussion and Final Remarks

This article allowed, first, to gather and organize scattered information about the specific history of packaging for ceramic ware in Asia and Europe, before the era of disposability, from publications in the areas of history, art history, and maritime archaeology.

From the analysis of images and written documents it was possible to identify and contextualize materials and techniques used in packaging through time.

Thus, the first maritime trade between different Asian countries, packaging for ceramic ware was also made of ceramic. Smaller items were packed under maximum pressure inside larger jars so that there was not a crevice left that could cause any damage. Due to the archaeological remains' alignment, it is plausible that rice straw, a by-product of the rice harvest, was also used to intertwine stacked items.

In a second historical moment, from the intense commercial (and cultural) trade between Europe and Asia in the 16th and 17th centuries, new techniques were introduced: using the autochthonous plant of great production and consumption in Asia – rice – combined with water, a compact mass was formed that allowed the porcelain to be well packed. It suggests, therefore, that it would be necessary to wash the ceramic items at the destination and, in addition to the consumption of water and the food product itself, it implied a considerable increase in weight. This fact is closely related to the technology of that period since large vessels needed ballast to obtain and maintain navigation stability. On the other hand, this characteristic is nowadays unnecessary and avoidable due to the minimization of energy waste and costs: packaging should be as weightless as possible.

Packages were produced in wood or other vegetable fibres, in barrel or case forms, sometimes adopting partial or total shape of the object, showing manual cooperage and carpentry techniques. The large ceramic pots continued, throughout centuries, to be used as containers for smaller porcelain items.

In the 18th century, with the growing demand for tea in Europe, this native Asian plant of great local production, consumption, and strong cultural tradition, was also used to pad porcelain in large rectangular wooden cases.

In the first half of the 20th century, other natural materials were introduced, such as paper, hemp, and cotton fabric: the applied materials were organic and from local sources, presenting great durability, and thus enhancing reusable packaging characteristics and the ability to be reintegrated into a system of natural renewal at the end of its life cycle.

Regarding 'Grestel packaging', an engineered type of local wood (poplar plywood), similar to the millenary wooden packages, was chosen. Also, waste and by-products resulting from Grestel ceramic production were incorporated in a new textile product. Hence, packaging materials that prevail over centuries – wood and ceramics – are also present as a contemporary solution of this ongoing research.

This study allowed us to highlight the effectiveness of non-disposable packaging for ceramic ware which, due to its fragile and heavy nature, is a challenging content.

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Track 2

Intersectional Design for an Accessible and Empowering World

Social positions and identities are multiple and seek to reveal the interconnected systems of subordination that together influence people's life chances. Extending beyond gender-specific and empowering categories of social identity (youth, old age, disabilities, non-heteronormative sexuality, despised ethnicity, income, religion and more), intersectionality focuses attention on a variety of multi-level interacting social locations, forces, narratives, norms, factors and power structures that shape and influence human life.

Intersectionality is increasingly suggested an innovative design framework with the potential to advance understanding of, and action, on inequalities, by highlighting processes of stigmatization, but mainly to encourage a critical reflection to move beyond singular categories, foregrounds issues of equity.

The track intends to collect design studies and practices which include the perspectives and worldviews of people who are typically marginalized or excluded, in which social justice and equity can be understood as a way of transforming how resources and relationships are produced and distributed to ensure a dignified and ecologically sustainable life for all. It also aims to outline in which way the dimensions of time and space, fluid, changeable and experienced through our interpretations, senses and feelings, influence different kinds of knowledge, through a deconstruction of the conventional social orders of meaning. Possible topics include concepts of accessibility, empowerment and people autonomy.

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Intersectional Design for an Accessible and Empowering World: Views from the 8th Forum of Design as a Process

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Abstract

Intersectionality is increasingly suggested as an innovative framework with the potential to advance the understanding and the action towards contrasting inequalities, by highlighting processes of stigmatisation and by encouraging a critical reflection to move beyond singular categories. The contribution explore the relation between the intersectional approach and design cultures and practices by presenting the main outcomes of Track 2 “Intersectional Design for an Accessible and Empowering World” in the frame of the 8th International Forum of Design as a Process. The contributions collected in this frame represent a wealth of practices, methods and applications that show how the theoretical contribution linked to the topic of intersectionality can be applied to the co-creation of innovation in design-driven practices in diversified geographies.

Keywords

Sustainability
Ethics
Transitions
Systemic Approach
Planet-Centricity

Introduction

The term “intersectionality” was first proposed by Black feminist legal scholar Kimberlé Crenshaw in her article “Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics” (Crenshaw, 1989). According to Crenshaw’s definition, social positions and identities are multiple and seek to reveal the interconnected systems of subordination that together influence people’s life chances. Extending beyond gender-specific and empowering categories of social identity (youth, old age, disabilities, non-heteronormative sexuality, despised ethnicity, income, religion and more), intersectionality focuses attention on a variety of multi-level interacting social locations, forces, narratives, norms, factors and power structures that shape and influence human life.

Intersectionality is increasingly suggested as an innovative design framework with the potential to advance the understanding and the action towards contrasting inequalities, by highlighting processes of stigmatization and by encouraging a critical reflection to move beyond singular categories, foregrounds issues of equity.

At the beginning of the design phase of the Forum, it emerged the importance to dedicate a specific track to this topic, with the aim to collect innovative and various perspectives from different geographies about the growing relation between the concept of intersectionality and design practices.

The Track 2 “Intersectional Design for an Accessible and Empowering World” collected contributions by designers, key experts and professionals who are promoting design studies and practices with the aim to include the perspectives and worldviews of people who are typically marginalized or excluded. At the same time social justice and equity have been assumed by the different authors as a way of transforming the way in which resources and relationships are produced and distributed to ensure a dignified and ecologically sustainable life for all.

Through a deconstruction of the conventional social orders of meaning, new dimensions of time and space emerged: fluid, changeable and experienced through our interpretations, senses and feelings, with a direct influence on the production of different kinds of knowledge.

Topics

The contributions collected in this volume, which shows the results of the call for papers, represent an application of the concept of intersectionality through design practices which covers various topics, both from a product or service development perspective, and from a more critical or process-related perspective and which covers many diverse territories and contexts. As curators of the Track, we have decided to group them into five main topics, that have to be considered as transversal instead of defined clusters. Each paper has developed one or more topics relating it to specific projects and contexts, leading to the fact that the concepts of intersectionality, empowerment and accessibility could be interpreted and applied in various ways, as an approach, as a methodological driver or as a dimension to be included in design solutions.

The first main topic is related to Empowerment as a key dimension for Design. The contributions related to this topic present the role of Design practices as an activator, or a tool for empowering citizens, communities and local actors in diversified territories, in particular vulnerable ones:

- the paper of Santos da Silva & Severo de Borba propose an analysis of existing social innovation initiatives in São Paulo, Brasil, in order to individuate strategic guidelines to promote the innovation of vulnerable territories through the empowerment of women. In this case, the empowerment of small communities is enhanced by a design-driven process.
- the article by Bárbara Pino Ahumada shows how design activism could have a role for the empowerment of territories and its actors, taking into account the case of Chileans' municipality of Alto Hospicio which is affected by environmental problems due to effects of production chains of textile products related to the Fashion Industry.
- finally, the work of Daniel Moreno, Katherine Mollenhauer and Arturo Orellana shows how service design could serve as a mean for empowering communities, by creating platforms to give equal voice to all the inhabitants of a territory. The process presented has involved more than 2000 inhabitants of Los Lagos, Chile through digital online workshops and events for participatory territorial planning.

The second main topic is related to Sustainability for all. The papers included in this topic consider a broad meaning of sustainability, both addressing the environmental dimension and the social dimension and studying how intersectionality and inclusive design practices could act towards a more sustainable future:

- the paper by Daniela D'Avanzo and Salvatore Zingale address the topic of social sustainability in relation to the identity of a place by applying a methodology based on ethnography and semiotics theory on a neighborhood placed in Roma, Italy.
- the article by Alessandro Pollini, Pilar Orero & Alessandro Caforio presents the experience of the project GreenSCENT in which an approach based on intersectionality, inclusive and Universal Design is proposed to face challenges related to climate change.

The third topic is called "Intersectional Magnifier for Gendered Innovation". Starting from the concept of gendered innovation (Schiebinger et al., 2011-2020) the works included in this section envisages the adoption of a gender-attentive perspective when producing products and services:

- the paper by Sergio Degiacomi, Francesca Zoccarato, Simone De Pascalis, Pietro Crovari and Fabio Catania foresees the application of an inclusive user research process for designing an interactive exhibition about sustainable development and the ONU SDGs.
- the article by Monica Oddone, Marco Bozzola and Claudia De Giorgi propose a reflection on the role of merchandising strategies in cultural communication in order to propose design methods for making communication products more accessible and inclusive.

The fourth topic has been defined “Enabling Technologies for People Autonomy”:

- with the contribution of Yi Zhang and Raffaella Trocchianesi, the topic of inclusivity is addressed through the perspective of sound in museums, particularly those in Lombardy. The research focuses on the study of sound design and storytelling strategies that promote accessibility in museums and evaluates their power to reach different audiences.
- Federica Delprino’s paper moves from an analysis of the process that led to the realisation of various technologies designed for people with disabilities, proposing a reflection on when and how designers should intervene in the creation of their designs to ensure the accessibility and usability of the resulting artefacts.
- the work by Alessandra Bosco, Fiorella Bulegato and Silvia Gasparotto offers a reflection, starting from the evolutionary events of the archive, on the main factors that have characterised the process of the progressive opening of the archive towards inclusion, from the social political cultural impact to the discipline of user experience.
- the article by Luis Erik Hernández Sánchez, Enrique Herrera Lugo, Jaime Francisco Gómez Gómez, Francisco Javier González Madariaga proposes an analysis of the effects of the implementation of universal design principles on the level of workstation exclusion and musculoskeletal symptoms and on the productivity of workers at a metal processing plant in the Guadalajara Metropolitan Zone.

The last main theme is concerned with Design Community-Based Relations. The papers related to this theme emphasise the importance of re-centring the needs of historically marginalised communities in the design-driven process and show the benefits of accountability approaches while discouraging extractive ones:

- Beatriz Bonilla Berrocal’s contribution “Viva! Colinas. Design for tourism and reconciliation in communities of former Colombian guerrillas” exposes the process, and possible outcomes, of designing a tool for integration and community participation in a strategic and complex Colombian area, starting from the historical and social analysis of the territory. It also exposes a possible solution for the development of a tourism product that encourages the connection and utilisation of the community’s unique knowledge through co-creation activities.
- the paper by Pedro Fragoso Lopes and Gonçalo Gomes aims to study the impact of Creative Industries in combating population decline in rural environments, by testing a methodology based on ethnography in the case of Sever do Vouga, Portugal.
- the work of Irene Caputo, Marco Bozzola and Claudia De Giorgi provides an overview of practical applications of product design that explore the relationship between multi-cultural society and cultural accessibility and aims to reflect on which and how methodological strategies could be implemented within a design process centred on an intercultural approach. It then opens up a series of design questions

related to the world of food, a particularly effective field for the construction of an intercultural narrative.

- the article by Ilaria Mariani, Francesca Rizzo, Grazia Concilio offers an insight into a critical issue related to migrants' access to public services as a barrier to integration, starting with the "easyRights" case study, a Horizon2020 IA project, and its experimentation in four pilot projects, providing a series of reflections on the transformative impact of this practice.
- Last of all, the article by Edgar Andrés Martínez Muñoz and Diana Marcela Giraldo Pinedo draws attention to the possibilities for innovation arising from knowledge exchange practices between craft knowledge and design-led projects, starting from an academic exercise.

Discussion and conclusion

The concept of intersectionality has provided the basis for a long and slow paradigm shift that is still unfolding in the social sciences, legal studies, and other fields of research and practice (Crenshaw, 1989, von Hippel, 2009, Bucchetti, 2015, Costanza Chock, 2018). The link among intersectionality, accessibility and empowerment activates new dynamics able to overcome the segmental understanding of the phenomena connected to discrimination, social exclusion, stigma, etc.

This paradigm shift is starting to transform the design industry as well, promoting multifaceted interventions able to amplify collective efficacy, valuing of marginalised persons and their autonomy, community solidarity and tacit knowledge (Collins, 2010).

The contributions collected during the Forum represent a wealth of practices, methods and applications that show how the theoretical contribution linked to the topic of intersectionality can be applied to the co-creation of innovation in design-driven practices. Among the various aspects that emerged, the collected contributions highlight some transversal aspects that deserve in-depth study from the point of view of design cultures, both in theoretical terms and in terms of the development of shared practices:

First of all, the diverse practices collected show how adopting intersectional approaches makes it possible to develop projects suited to countering global challenges that transcend geopolitical differences while having situated local impacts.

This is the case, for instance, of actions to counter the climate crisis, which produces different effects in relation to different socio-identitary categories of the people affected by it (considering, for instance, of the different impact that effects related to the climate crisis have in relation to gender or income). Adopting an intersectional approach makes it possible to consider the differences of the different communities and improve their empowerment in the construction of counteracting actions that are more inclusive in their impacts, with a view to social as well as environmental transition. Secondly, the adoption of intersectional approaches in design practices supports the construction of projects towards marginalized and not represented communities, while improving the collection of data and information useful for the understanding of localised problems and needs among diverse communities, enabling the description of

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'submerged' phenomena that normally escape institutional frameworks: it allows the construction of tailored tools useful for people autonomy, but also to dismantle systems of inequality.

Finally, the collection of contributions highlights how design-related cultures and practices manifest themselves in differentiated contexts, both in terms of scale (from the building scale to the territorial scale) and in terms of existing and preferred relationships, showing how design and the designers appears as mediators between different knowledges, rather than as producers of the same. The intersectional approach, and the theoretical contribution linked to intersectionality, helps to define design practices that mediate between situated knowledges (Haraway, 1988), that are radically linked to the bodies and experiences of the communities that produce them.

"We must do this in order to deepen the strengths that exist from the differences that we all bring to the table: whether it's from our disciplines, from our resources, and from the intersectionality of our identities. If we can begin to appreciate our difference, we will see the disbursement of power in places where we are creating and intervening." (Amatullo et al., 2021, p.57)

The interplay between the concepts of intersectionality, empowerment, accessibility ensures the identification of hidden structural barriers and supports an understanding of how individual experiences differ¹. The development of design solutions able to capture needs and opportunities that intersect and interact, can offer a real contribute to resolve root causes of inequality, injustice, and insecurity, and at the same time, to improve impact, sustainability, and relevance of responsible innovation initiatives across the globe.

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Viva! Colinas. Service Design for Tourism and Reconciliation in Communities of Former Colombian Guerrilla

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Abstract

As a result of the 2016 peace agreement in Colombia, ex-combatant communities in the ETCR Jaime Pardo Leal in the Vereda Colinas inside the Guaviare region, recognized the potential of tourism activities to support economic growth and ensure their subsistence in rural areas. This project explores how design approaches, qualitative research, and interviews with community members facilitated the design of a community integration tool. Based on service design and user-centered methodology, Viva! Colina's toolkit comprised five workshops to train ex-combatants in tourism essentials. The application of the tool resulted in the creation of two tourist routes, reflecting the community's desire for reconciliation and preserving historical memory while generating economic benefits.

Keywords

Ex-combatants

Peace

Tourism

Colombia

Service Design

Introduction

The Colombian social conflict, lasting over five decades, has profoundly impacted the country, leading to displacement, violence, and significant challenges (Cartagena, 2016). The present phase in Colombia's history calls for dedicated efforts to end violence, address drug trafficking, support war victims, reintegrate ex-combatants, and successfully implement the 2016 peace agreement. This crucial moment provides an opportunity to reshape Colombia's path and cultivate a future characterized by peace, stability, and inclusive development.

The protracted conflict in Colombia subjected the population to distressing experiences such as kidnappings, massacres, and human rights violations (Bello Montes, 2008). These acts of violence instilled fear in communities and deterred both domestic and international travelers from perceiving Colombia as a safe and appealing destination. As a result, many previously thriving tourist attractions in the country were abandoned, negatively impacting the tourism sector's economic contributions and impeding the development of various regions (Mackey Montoya & Peña Pérez, 2016). However, the end of hostilities, disarmament processes, and the creation of transition spaces for ex-combatants, particularly the ETCR Colinas and Charras, have opened up new possibilities for tourism development in Colombia. Guaviare, a department deeply impacted by the conflict and known for its proximity to the Amazon rainforest, is an intriguing case study, becoming a focal point for rejuvenating tourism in a peaceful environment, capitalizing on the absence of active armed groups within its borders.

Amid various reintegration options for ex-combatants, tourism remains an underexplored avenue. This research, conducted in collaboration with ex-combatants from the ETCR Jaime Pardo Leal in Colinas, aims to explore the untapped potential of tourism activities shaped by their intimate knowledge of the region, close relationship with nature, and active community involvement. The investigation will comprehensively analyze the current state of the Jaime Pardo Leal territory, including its community members, existing tourism approaches, and the feasibility of developing an organic tourism proposition in this distinct context. This investigation addresses misinformation, resentment, and apprehension that impede visitation to post-conflict areas. By engaging ex-combatants and leveraging their experiences, this research introduces the "Tourism for Reconciliation" concept, demonstrating how tourism can promote healing, preserve history, and foster community connections.

ETCRs: Reintegration Challenges and Tourism Opportunities for Peacebuilding in Colombia

The 2016 peace agreement in Colombia established transitory spaces, currently known as ETCRs (Espacios Territoriales de Capacitación y Reincorporación), to facilitate the reintegration of combatants into civilian life (Ríos, 2017). However, these spaces face significant challenges, such as limited connectivity, mobility, and essential services, which isolate them from major cities (Misión Observación

Electoral, 2017). Despite these obstacles, the ETCRs have been instrumental in supporting the economic and social reintegration of ex-combatants by providing training in diverse areas, financial support, assistance in establishing productive projects, and essential services like healthcare and education (CAPAZ. Instituto Colombiano-Alemán para la Paz & Heinrich Boll Stiftung, 2018). After nearly eight years since the FARC disbanded, the Colombian peace process has made significant progress, demobilizing over 50,000 ex-combatants and fostering hopes for a better future. However, existing factors pose potential threats to the long-term sustainability of the peace plans, including security concerns (Torres Martínez & Ríos Monroy, 2021), ongoing stigmatization, and the need to maintain productive projects, and housing initiatives, improve education (Martínez & Lefebvre, 2019), and establish connections beyond the ETCR spaces. Addressing these challenges is crucial for ensuring the stability and progress of the peace process and allowing the ETCRs to continue their positive impact and integration into local governance structures.

Located in the Guaviare department, the ETCR Jaime Pardo Leal (ETCR-JPL) in Capricho, Colinas, has gained recognition for its dedication to peacebuilding. It is the only ETCR ready to be handed over to the residing ex-combatants, demonstrating its successful transition (Martínez & Lefebvre, 2019). Situated in a remote area approximately 49 km from San José del Guaviare, the ETCR-JPL serves as a gateway to the Colombian Amazon. It accommodates nearly 400 individuals [Fig. 1](#), primarily former combatants, and presents essential services through water purification and diesel-powered plants (Vega Araujo, 2020). The ETCR-JPL community actively engages in training and project development activities, particularly in the rural sector, with support from the Colombian Government, international cooperation, and the private sector. Additionally, the community seeks to harness its unique territory, rich in natural resources, to promote tourism and foster reconciliation by sharing its perspective on war experiences and challenging negative stereotypes. Exploring tourism opportunities in the ETCR-JPL serves as a critical asset to contribute to the community's economic and social stabilization of the community (Ministerio de Comercio, Industria y Turismo, 2020) but also facilitates contact between visitors and the actors of the former armed conflict, fostering peace and understanding while preserving the true meaning of peacebuilding.



Fig. 1
Quintero, Juan Camilo.
(2019). ETCR-JPL Houses.
[Photo]. Own archive.

Methodology

A comprehensive methodology was proposed to analyze the ETCR area's tourism potential, emphasizing community collaboration. It employs qualitative and quantitative research methods, providing evidence-based insights and guidance for sustainable tourism development. The analysis contributed to a design tool for long-term growth, cultural preservation, and improved visitor experiences.

Evaluation: ETCR-JPL area tourism potential, as a visitor perspective

Interviews were conducted with 20 visitors to the ETCR-JPL area Fig. 2, including young Colombian tourists, middle-aged foreign tourists, and family groups. These interviews aimed to understand visitors' knowledge, information needs, and the importance of community engagement. The analysis revealed four key activities for tourism development: community witnessing, storytelling, connecting with the principal city, and highlighting the area's unique value. However, challenges such as remote location, inadequate infrastructure, limited transportation, and a lack of trained guides were identified. Collaboration with stakeholders was necessary to improve transportation, enhance storytelling techniques, define a compelling value proposition, and strengthen communication and promotion efforts. By addressing these issues, the ETCR-JPL area could establish itself as a sustainable and distinctive tourism destination, aligning with visitors' perceptions and preferences.



Fig. 2
Tobos Jiménez, Rodrigo Andrés. (2021). Visitors of the ETCR-JPL. [Photo]. Own archive.

Identification: Deepen into the ETCR-JPL community

During the community identification stage of ETCR-JPL, virtual interviews were conducted in August 2021 with 35 influential participants, including tourism committee members and community leaders Fig. 3. The interviews focused on individual and community roles, skills, community involvement, and goals. Positive aspects, such as openness and motivation, were evident, with participants expressing a desire to share their skills and experiences. However, challenges related to internal disorganization, limited availability of specific members, and issues within the tourism committee were identified. These interviews provided valuable insights into the community dynamics and emphasized the importance of collaboration and the exploration of alternative projects for future growth.



Fig. 3
Tobos Jiménez, Rodrigo Andrés. (2021). ETCR-JPL representatives. [Photo]. Own archive.

Connection: Outside the ETCR-JPL, the stakeholders involvement

The community's outsider approach involved virtual interviews conducted in August 2021 with current and potential stakeholders of the ETCR-JPL community Fig. 4. Participants included tourism agency owners, UN peace verification representatives, and a Municipality of San José del Guaviare social leader. Positive aspects emerged, such as the willingness of interviewees to collaborate with the community and the interest of tourism agencies in showcasing the territory's unique aspects. However, challenges, including transportation costs, political discussions during visits, and slow implementation of ideas, were identified. This stage provided valuable insights into potential collaborations between external actors and the ETCR-JPL community in developing tourism activities, highlighting the need for improved collaboration and organization within the community. Addressing transportation, political discussions, and implementation challenges was crucial to establish successful partnerships and maximizing the community's economic opportunities.



Fig. 4
(2021). Stakeholders'
interview. [Image].
Own elaboration.

Co-Creation: Community building Tourism proposals for the territory

The co-creation stage involved virtual interviews with the ETCR-JPL community in September 2021 to ideate tourism development. Participants demonstrated commitment and eagerness to contribute, proposing various tourism experiences for different profiles. The exercise revealed a need for training and collaboration while highlighting challenges related to suboptimal tourist spaces and lacking training among community members. Positive aspects included participants' active engagement, the community's desire to develop alternative activities, and the tourism committee's unity of vision. However, negative points identified were suboptimal conditions in tourist spaces, the investment required for improvements, and the lack of training among community members. The exercise emphasized the community's commitment to tourism and the importance of addressing infrastructure, training, and implementation challenges to enhance visitor experiences.

Result: Tourism for reconciliation in the ETCR-JPL

Through the research process, the “Tourism for Reconciliation” concept emerged as a viable approach to support the ETCR-JPL community in developing a sustainable and economically feasible tourism proposal for their territory, aiming to establish meaningful connections between the community and external stakeholders, including service providers, educational institutions, and organizations interested in supporting the community’s local and international peace-building efforts. It is essential to recognize that while tourism has the potential to contribute to reconciliation and the transformation of societal perceptions, it cannot alone address all challenges or eliminate stigmatization. Nevertheless, it can serve as a valuable tool for fostering peace and shaping a new narrative.

The community design solution, later known as the Viva! Colina’s toolkit Fig. 5, was identified as a means to address the limitations and challenges specific to the ETCR-JPL context that could potentially hinder the success of a tourism initiative. By providing a structured framework and resources, the toolkit enhances the effectiveness of the community’s tourism efforts, ensuring they align with their sustainable development goals and economic prosperity.



Fig. 5
(2021). Viva! Colinas Logo.
[Logo]. Own elaboration.

Viva! Colinas: The process

To introduce the concept of “Tourism for Reconciliation” in the ETCR-JPL territory, five community workshops were conducted remotely between September and October 2021. These workshops engaged and trained community members, including representatives from the Tourism Committee and relevant experts. Despite connectivity challenges, the workshops aimed to gather data, share knowledge, and refine the tourism proposal development process. Activities included individual interviews and group discussions, ultimately involving and training the community in the tourism for reconciliation initiative.

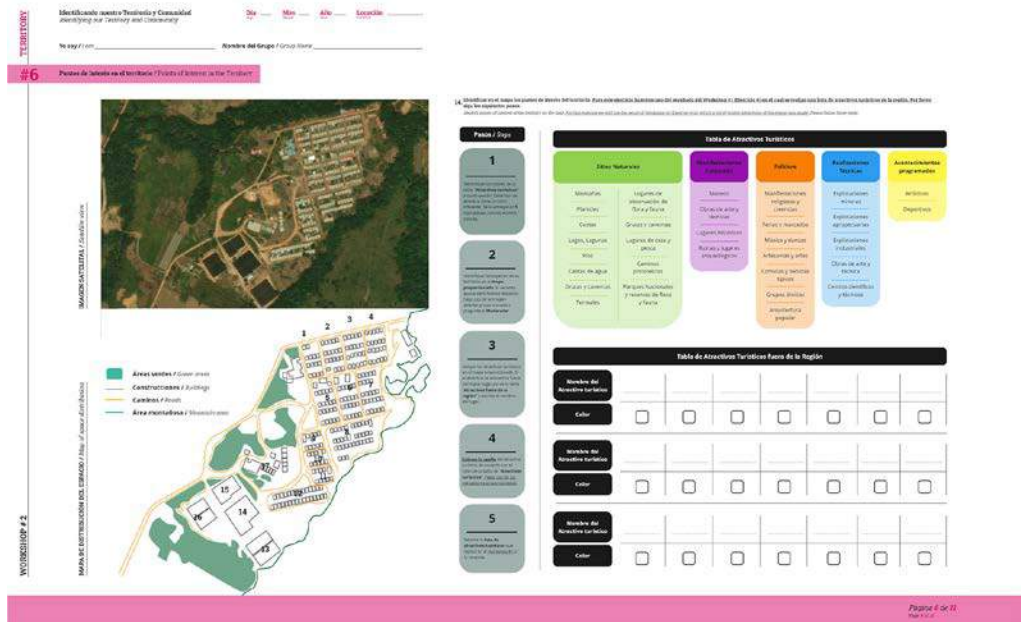
Viva! Colinas: The outcome

Throughout the five workshops, the community’s potential and needs became evident. Establishing empathic connections with community members was essential for successful community

co-creation. The support of tourist organizations, academics, and experts was crucial in engaging key community members and facilitating workshop activities. Despite the challenges of virtual interaction, this research project provided a unique opportunity for the community to explore new topics and build personal connections. As a result, the community developed two pilot tourist routes in January 2022, representing the first step towards co-created tourism activities within the community. The community's commitment to continuous improvement, peace, and reconciliation with the territory and society was evident throughout the process, highlighting the transformative power of co-creation and community engagement.

Viva! Colinas: The toolkit

Viva! Colinas is a series of five thematic workshop sessions that engage the entire ETCR-JPL community in the tourism development process. Facilitated by the Tourism Committee, community members, and stakeholders, these workshops aim to gradually create a tourist route and define the value proposition of the territory [Fig.6]. The workshops follow a step-by-step approach to establishing a definitive tourist route.



First Workshop: Activities

In collaboration with tourism agencies, the “Identify whom the activity is aimed at” workshop helps the community identify tourist profiles, target audiences for services, recognize local attractions, and gain a basic understanding of tourism concepts.

Fig. 6 (2021). Viva! Colinas activities for Second Workshop. [Image]. Own elaboration.

Second Workshop: Territory and community

The “Identify your territory and community” workshop, in collaboration with tourist guides and ETCR-JPL community representatives, deepens the knowledge of the territory, including its location, population, internal organization, attractions, and services, promoting knowledge sharing and alignment among participants for the final tourist route.

Third Workshop: Storytelling

The “Build your story” workshop, developed in collaboration with sociologists, involved individual and group exercises in developing storytelling skills for community members to share their experiences and ideas creatively and engagingly with the community and visitors.

Fourth Workshop: Community strengths

In collaboration with psychologists and anthropologists, the “Identify your strengths” workshop helps participants recognize their strengths and propose specific roles connected to the tourist route, aiming to instill a sense of vocation and responsibility among community members within the final tourism route.

Fifth Workshop: Roles definition

“Define your actions and roles” workshop, built upon the previous workshop and established the final roles and responsibilities of the actors involved. The goal was to collectively develop a pilot tourist route based on the community’s active participation, knowledge, and previous workshops process’.

Viva! Colinas workshops aim to decentralize tourism planning and promote active community participation. Integration with the ETCR-JPL community revealed the importance of skill development, community engagement, and employment opportunities. The workshops highlight the value of every community member’s contribution, fostering a spirit of co-creation in tourism for reconciliation.

Debate: Tourism in conflicts zone

Tourism initiatives in post-conflict zones have emerged as a means for communities to rebuild their economies and move forward, driven by individuals with personal connections to the conflict. These initiatives prioritize the untapped tourism potential of the regions rather than exploiting the morbidity associated with war tourism (Martínez-Gayo, 2021). They aim for sustainable development, empowerment and offer employment opportunities while contributing to infrastructure development and environmental awareness.

Positive impacts can be followed by analyzing case studies worldwide, such as in Indonesia, El Salvador, and Mexico. Aceh Explorer in Indonesia provided employment and contributed to tourism growth, highlighting the potential of such initiatives. However, challenges persist in the reintegration of ex-combatants (Young & Goldman, 2015). The Ruta de la Paz project in El Salvador showcases historical memory and employs former combatants but lacks further government support for its expansion and maximization of economic development and historic preservation (Bustabad Alonso & Ruiz de Andrés, 2010). Similarly, Zapaturismo in Chiapas, Mexico, overcame initial safety concerns and thrived, attracting visitors interested in learning about the Zapatista combatants and benefiting the local economy. Nevertheless, the risk of commercialization and overlooking peasant communities' struggles still emphasizes the need to balance profit and social impact (Hemispheric Institute, 2010).

To ensure the long-term sustainability and meaningful impact of post-conflict tourism initiatives, addressing these challenges and prioritizing safety and government respect is crucial. The analysis of the previous case studies demonstrates that, despite stigmatization, these initiatives have fostered dialogue, tolerance, and even international tourism, gradually changing the perception of ex-combatant groups. Accompaniment from governmental and private entities is vital, providing training, economic assistance, and spaces for community interaction. By leveraging the unique knowledge of ex-combatants, tourism can serve as a viable post-demobilization economic alternative, promoting reconciliation, communication, and dialogue as bridges to peace. It can create a sense of ownership and belong to the territory, empowering demobilized groups to work toward societal reconciliation, community improvement, and territorial cohesion.

Conclusions

Design strategies have untapped potential to enhance tourism and differentiate destinations (Stickdorn & Zehrer, 2009). Integrating service design principles with community-based tourism can unlock economic and social growth in underdeveloped areas (Ramírez Hernández, 2019) by actively involving the community, leveraging design tools, and establishing connections with external actors to strengthen proposals (Stickdorn & Frischhut, 2012). Design is a powerful tool in conflict contexts, enabling the development of sustainable and socially responsible solutions (Manzini, 2016). Inclusive approaches can address weaknesses and generate lasting solutions

through design thinking and co-creation with affected populations, empowering communities and fostering collaboration for transformative change. The design process should prioritize actors and their context, facilitating an understanding of accurate data and identifying specific needs.

A prime example of the successful implementation of design strategies is the ETCR Jaime Pardo Leal (ETCR-JPL), being a unique testament to the transformative power of peacebuilding and community engagement in a post-conflict setting, empowering former combatants to rebuild their lives and contribute to society by providing essential services, training programs, and support for productive projects. The ETCR-JPL community has embraced tourism as a catalyst for positive change by leveraging its unique territory, sharing its experiences, and attracting visitors. Integrating design strategies, particularly in community-based tourism, contributes to economic and social growth opportunities, benefiting the local community and the broader region (Ramírez Hernández, 2019).

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The Digital Archive as An Inclusive Tool for Knowledge Construction Through Design Practices

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Abstract

The paper offers a multi-focused reflection on the relationship between the evolution of the archive and the issues of access and knowledge acquisition. The authors recognize the digital archive as a resource that, from accessibility to information, through the empowerment of individuals, makes people autonomous in their own construction of knowledge. Briefly reconstructing the evolutionary events of the archive – from a private repository of documents to a platform for online content sharing – the research, through the presentation of some case studies, highlights the main factors that have characterized the process of the progressive opening of the archive towards inclusion: the *opening process on contents*, collected and organized to reach extended audiences by increasing social, political and cultural impact, and the *opening process on user experience* on which the design discipline works through interaction and experience practices.

Keywords

Digital archive
Knowledge accessibility
Design for inclusion
Interconnected systems
Empowerment

The archival impulse

From its origins, split between the roles of institution of power and custodian of memory, the archive boasts a thousand-year history (Giannachi, 2016, ch. 1). Established for administrative and political control, and non-research purposes, this ordered collection of documents is kept in a defined location to be reviewed and consulted when required. It became of public access only after the French Revolution, especially during the nineteenth century its spatio-temporal uniqueness is questioned and to the archive is given a value outside the *current* stage of verification of materials and beyond the place designated for collection, highlighting its characteristics as an object of historical and scientific investigation.

A further step toward the enhancement comes with the Hague Convention of 1954 thanks to which they are recognized and protected as an asset of cultural interest at the international level, regardless of their origins and owners. Therefore, archives are consolidated as *global relational places* for the construction and reconstruction of historical events, starting from the analysis and the interpretation of texts, images, correspondence, objects, artifacts, photographs and much more, that is, a composite set of materials that, since the 1930s, are defined as documents.

From being a container of documents preserving an identity (national, local, individual) it is increasingly transformed into a tool to be investigated in order to generate and circulate further knowledge as well as a medium for realizing new visions and reconstructions of the world (Baldacci, 2016), understandable only if it is studied from a broad perspective across different fields (Manoff, 2004).

With such and many other theoretical and practical facets, the archive in recent years, especially due to the development of digital technologies, has experienced a kind of globalization that made both the boundaries of its structure and the roles and functions associated with it more fluid (Clement, Hagenmaier & Knies, 2013), due to the progressive overlap with those of library or museum accentuating the aspects of content dissemination and production (Lupano, 2013; Zuliani, 2014). For those involved in interpreting documents, the development of digital technologies and the Internet has transformed research methods and tools by involving the humanities and promoting the specific field of study of digital history (Weller, 2013).

This epochal change has produced digitized and digital archives and it has allowed many collections to be uploaded, shared or enriched by other users of the internet (Schnapp, 2008). Each user thus simultaneously assumes the role of producer, consumer, and transmitter of one of the “fundamental devices for describing and tracking everyday reality” (Giannachi, 2016, p. XVII), and archives progressively become the *interfaces* through which to interact with the world on a social, political, economic, and cultural level. At the same time, thanks to the ongoing digitization of documents and the application of machine learning processes, the forms that the archive has taken – from atlas to album-diary, from *wunderkammer* to filing cabinet, from inventory to catalog – have been augmented and expanded through the construction of multidimensional relationships between texts and images in platforms, also enhancing the experiences within physical spaces.

The archive – digitized or digital – has thus become a potentially open and accessible tool, a resource for structuring projects and, at the same time, a dynamic support for collective memory.

Useful for sharing and constructing knowledge, it includes as authoritative sources those coming “from the bottom” such as oral testimonies, personal photographs and videos or private documents.

The new ways of producing contents and the diffusion of digital technologies ensure to simplify the acquisition and sharing of materials and to provide a greater accessibility to information by fostering a culture oriented towards the common good (Hussain, 2018) and social equity (Dombrowski et. al, 2016).

From these premises, the paper interprets the theme *Intersectional Design for an Accessible and Empowering World* through a reflection on the archive as a tool for deconstruction of the conventional process of learning, questioning the linear path where learners have access to information selected by those who, in different ways, impart it.

Pursuing this goal, the authors have developed a multi-focused reflection on the relationship between the evolution of the archive and the issues of access.

The authors recognized the archive as a resource capable to testify the history and culture of a society through the records preserved, a real tool that, from accessibility to information, through the empowerment of individuals, makes people autonomous in their own construction of knowledge.

Methodology

Having briefly reconstructed the evolutionary events of the archive – from a private repository of documents to a platform for sharing online content the research – the analysis of some case studies, identified the main factors that have determined and characterized the process of the progressive opening of the archive toward inclusion.

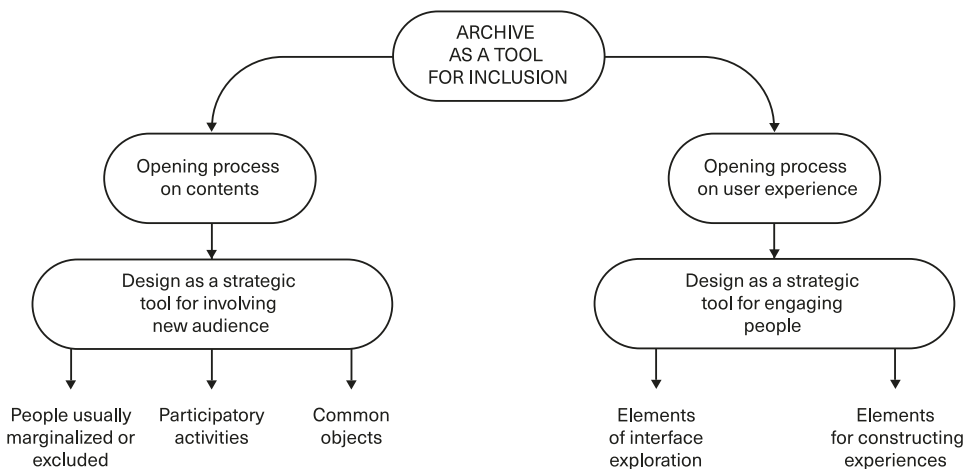
Case studies were identified through preliminary research of keywords– digital archive, knowledge construction, learning accessibility, openness and inclusion, empowerment of marginalized people, archive's interface, digital tools for engagement and enhancement of memory – on the principal's online search engines – Google and DuckDuckGo –, in scientific journals or thanks to referrals from members of the academic community.

Within a collection of 40 case studies, 26 of them were considered inherent to the research, based on the following parameters: partially or fully digital or digitized archives, inclusive topic, ease of interface navigation, engagement of the community, UX/UI innovation.

Based on the selected case studies, two prevalent actions have been identified by the design perspective [Fig. 01]: the *opening process on contents*, on which design can be considered a strategic tool for reaching and involving extended audiences; and the *opening process on user experience* on which the design discipline works through interaction and experience practices. For each action, other sub-categories – supported by the description of a paradigmatic case study – emerged, and converged, finally, in a closing framework. Each case study included within the text has been listed in a summary table together with its web page (Bosco et. al, 2023).

The *opening process on contents*, identifies: the collection of documents on previously little-covered topics involving ordinary people and usually marginalized minorities; the direct involvement of curious people and enthusiasts in participatory activities aimed at the implementation and dissemination of the collection; and the cataloging of common objects, produced to accompany people in their daily lives, elevated for this reason to traces to be preserved and enhanced.

The *opening process on user experience* is supported by the digital transition and more specifically by the digitization of documents that has made preserved collections at least partially accessible online. In this regard, design stands as a tool capable of enhancing content and the user's visit experience. *Elements of interface exploration* appropriately designed simplify the search phase, articulate the reading of content and enable guided navigation of complexity. The integration of *elements for constructing experiences* such as likes, feedback, call to action makes user participation active and direct.



“Opening process” on contents

The goal of inclusion finds in digital tools the possibility of extending the dissemination of the archive to a wider audience (Schnapp, 2008; Granieri, 2011; Floridi, 2020). The action is aided and augmented by the expansion of the type of content collected by the archives. This “process of opening” (Gasparotto, 2019) triggers dynamics of inclusion that are articulated in several actions and concern the implementation of the collections held, the target audience addressed, the type of classified assets, the mode of collection, and the dissemination of the collections.

Document collections related to ordinary people and cultures who are typically marginalized or excluded propose a new focus on subjects and issues not previously covered. The *Archivio Diaristico Nazionale* in Pieve Santo Stefano, for example, has collected since 1984 more than 9,000 diaries, autobiographical memoirs capable of bearing witness to the history of a country through

Fig. 1
Archive as a tool for inclusion, 2023. Credits: Bosco A., Gasparotto S.

the narration of testimonies, enriched since 2013 by the creation of the *Piccolo Museo del Diario*: a multisensory and interactive path.

Works on reconstructing the memory of 9/11 through the collection of documents from the grassroots – both from people who experienced the event firsthand and through outside testimony – *The September 11 Digital Archive*. The archive, through interviews, photos, video, audio, correspondence, newspaper articles, and other types of documents intends to reconstruct the memory of the event for present and future generations and is an example of how a historical fact can be documented and preserved in the 21st century. The extent of the documents preserved concerns both the origin of the sources – testimonies are collected that come from all over the world – and the variety of document types, digital formats that are not always usable due to the obsolescence of the technology in use. User engagement, in the specific case, occurs by placing the history of the person at the center and by seeking the self-recognition of the audience.

It works on the same goals the *LGBTQ Community Center National History Archive*. Of particular interest for the variety of different media, their time span – the earliest records are from 1878 – and the number of items collected, this community-based archive collects, preserves, and makes available to the public the documentation of LGBTQ lives and organizations centered in and around New York.

By considering common sources and resources usually excluded from traditional temporary exhibitions and museum heritage the ephemera archives collect and catalog common objects, produced and designed to accompany people's lives on a daily basis, elevated in this case to traces to be preserved and enhanced, useful for reconstructing political, economic, social and environmental histories from multiple points of view. The *American Left Ephemera Collection*, for example, collects documents from the 1890s to the present. The materials were produced by the Socialist Party USA, Communist Party USA, Students for a Democratic Society or their affiliated organizations, as well as unaffiliated activists and radical intellectuals. The *Digital Archive of Latin American and Caribbean Ephemera*, powered by Princeton University Library, collects from 2015 “pamphlets, flyers, leaflets, brochures, posters, stickers, and postcards originally created by a wide array of social activists, non-governmental organizations, government agencies, political parties, public policy think tanks, and other types of organizations in order to publicize their views, positions, agendas, policies, events, and activities.” (Princeton University Library). The bottom-up contribution contemplated by the digital archive structure can therefore include both the sharing of private documents suitable for the implementation of the collection, and the direct involvement of curious people and enthusiasts in participatory activities aimed at the storage experience and dissemination of the same.

Aimed at implementing the collection by proposing to its users to collaborate actively *Lettere di Casa Ricordi* involves scholars and enthusiasts in the transcription of handwritten letters which, thanks to this operation, become documents that can be consulted and easier to read. Furthermore, the archive, relying on a network of volunteers, can enrich the consultable heritage while having limited resources.

“Opening process” on user experience

The processes of inclusion also concern its use and usability. Within this field, the designer, together with a multidisciplinary team, can make a significant contribution.

The issues faced by the historian – such as the study, preservation and historicization of “native” digital documents –, together with the definition of web-based navigation platforms developed to describe, connect and compare data – through Linked Open Data (Listo, 2019), algorithms and artificial intelligence systems (Kaplan & di Lenardo, 2020) –, involved the skills of the designer who, as a hybrid figure among theoretical, practical, humanistic and technical-scientific knowledge, can contribute to make it accessible and more usable.

Through the design of interfaces and experiences the team can organize and visualize contents (Windhager et. al, 2018) in order to facilitate the research, supports navigation paths defined by the curator, and guides the narration maintaining a balance between synoptic vision and storytelling (Mauri & Ciuccarelli, 2014).

If the care and attention used in the design of navigation path and the definition of orientation systems guide users within the complexity of the collected content, the study of behavior patterns, user research, human factors analysis, and the development of participatory systems enable them to direct actions performed autonomously.

On the one hand, design can work on the inclusion of new audiences defining the *elements of interface exploration* through the design of easily navigable interfaces and informative narrative systems – thanks to visual expedients, a clear structure of the information architecture and tools that help to amplify the possibilities of sharing –. Elements of interface exploration can be: interactive maps, interactive timelines, galleries, thematic path, interactive data visualizations, 3d visualization.

On the other hand, design can make the archive more inclusive and engaging through the project of digital, physical or hybrid experiences that can enhance the collection and encourage the creation of networks and the bottom-up participation of users. *Elements for constructing experiences* can be: like, personal feedback, private or public galleries, call to actions. The articulation of building elements of *interface* and *experience* Tab. I are neither exclusive nor unique, in fact, they are modifiable and implementable according to the project and heritage characteristics.

ELEMENTS OF INTERFACE EXPLORATION	ELEMENTS FOR CONSTRUCTING EXPERIENCES
Interactive Maps	Like
Interactive Timelines	Privet/Public Gallery
Galleries	Call to Action
Thematic Paths	Persona Feedbacks
Interactive Data Visualization	
3d Reconstruction	

Tab. I
Elements of interface exploration and Elements for constructing experiences, 2023. Credits: Gasparotto, S., Bosco A., Bulegato F.

Among *elements of interface exploration*, those aimed at orienting the user into the spatio-temporal dimension of the preserved heritage are the *timeline* and the *map*.

If the *Baldessari archive* proposes an overall view by organizing all the projects labeled with its name, on several *timelines* in a single horizontal scrolling stream, *Fashion Exhibition Making* works on a timeline that scrolls vertically, displaying projects through galleries of images, articles and products that give the user an immediate idea of the documents included.

If the Renzo Piano Foundation's archive georeferences the firm's projects on an *interactive map* in which a click on the pin corresponds to the opening of a meaningful image that directs to a more in-depth look at the project, in *MilanoAttraverso* – project focused on the exploration of the territory of Milan, promoted by *ASP - Azienda di Servizi alla Persona* and Golgi Redaelli – many local private and public archives and institutions are displayed through different types of icons that identify and georeference institutions and classified document categories (Bollini, 2021).

Aimed at creating visual systems for orienting the user within the heritage, the *gallery* is one of the most common tools used by designers to implement digital archives. The *Bauhaus Archiv's photographs* is, for example, clustered by curators into categories, and immediately visualized by *galleries*.

A more articulate and immersive reading of the heritage is the one of the *Magistretti Archive*, which combines the *gallery* and the *timeline* with *thematic paths* capable of connecting heritage elements in a cross-sectional way, introducing original curatorial narratives. At a different scale but with the same aim, the multiple *thematic paths* proposed by the extensive online image collection of *Google Arts & Culture* are predominantly based on images and metadata attributed to them by the Cultural Heritage professionals.

With a different level of complexity, the tool of *interactive data visualization* offers a systematized visualization of the data collected within the digital archives using algorithms. For example, in the *Historical archives of Italian psychology (ASPI)* the tool of *interactive data visualization* put on evidence the individual's relationships through reshaping the network view, and to access the respective biographical record.

Introduces a *third-dimension visualization*, *Venice Time Machine*, a project based on the digitization of personal and administrative documents, floor plans, works of art and photographs, which, thanks to machine learning processes, contributes to the reconstruction of the map of Venice in relation to the specific period. The user by navigating the timeline can watch the evolution of the building of the city over time.

Another *3d visualization interface* is *Chronogram*, the project developed by EPFL+ ECAL Lab and the Digital Humanities Lab of the EPFL in order to explore the documents of *Vacheron Constantin archive* through a VR viewer.

The most popular practices of engagement, among the *elements for constructing experiences* are the assignment of the *like* and the selection of documents for structuring public or private galleries. *Europeana*, from this point of view, is one of the most comprehensive digital archives by including a specific section where the user, by logging in, can put the like, build personal galleries, or even participate in writing blog's articles.

The tool of *personal feedback* often found in platforms such as blogs or social networks to promote public and critical participation is also implemented in some archives, such as the *British newspaper archive*, which integrates daily comments from Twitter's users within its homepage.

Another engagement experience is the *call to action*, which, in the specific case of archives, is often useful for collecting personal materials. Examples are: the *Youth Club Archive*, which offers the possibility to submit photos, flyers, tickets or other memories about subculture or counterculture mainly belonging to British people, and *Design in quarantine* that "collects in an online and open source platform, the multiple design responses to the pandemic through the construction of an archive updated in real time." Posters, infographics, custom-made or *hacked* furniture and other design projects were collected through an open call.

Finally, *Europeana* proposes another practice for engaging and nurturing its community: the organization of online events. An example is *The Digital Storytelling Festival 2022*, organized in May together with *the heritage lab*.

Conclusion

Systems based on inclusive archiving are important for preserving individual views, practices, and contexts that generate them, documenting the histories as well as the social needs of those they represent (Giannachi, 2016, p. XIX).

Design emerges as a doubly strategic tool in the process of opening-up the archive toward an inclusive knowledge construction increasingly aimed at life-long learning. Through storytelling practices design can enhance and bring out the classified heritage. Working on identifying cross-cutting pathways among the collected items it can renew the collection's narrative over time. By promoting call-to-action and participatory activities it attracts and engages new and broader audiences. Using appropriate languages and visual media facilitates an immersive experience. By making content clearer, readable, and usable, it ensures a learning experience that is at once accessible, in-depth, and entertaining Fig. 2.

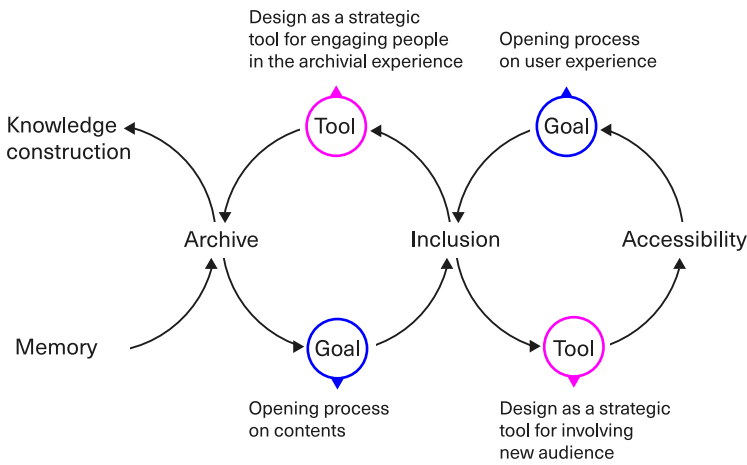


Fig. 2
The digital archive as an inclusive tool for knowledge construction through design practices, 2023. Credits: Bosco A., Gasparotto, S.

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Content collection and digital nature of the archive are prerequisites, but not sufficient to define its inclusiveness. In this regard it should be premised that a source is never “objective” but is the result of voluntary or involuntary processing by the epoch and society that produced it. Furthermore, it is conditioned by the knowledge, skills and values as well as the cultural and technical tools of the context that designs and implements it. It follows that the archive can never be completely inclusive since it cannot represent those who do not have the ability to use tools for the fruition and sharing of content.

Further critical to inclusion is the non-linear distribution over time of the materials stored in many digital archives. In fact, a large part is made up of digitized items that refer to documents from the last few decades, and only a tiny amount relates to records from more than thirty years ago (Time Machine).

Regardless of the completeness and historical consistency of the preserved elements, for which the designer’s contribution may be only marginal, the inclusion-oriented design activity must devote itself to carefully representing the complexity of the archive while providing insight, original points of view, and stimulating active user through design proposals that can empower individuals by making them autonomous in their own knowledge construction, toward sharing a common good with an ever-extending community both academic and public.

Authors’ Notes

The contribution is the result of a common reflection of the authors. Nevertheless, Chapter 1 was written by Fiorella Bulegato, Chapter 2 was written jointly by Alessandra Bosco and Silvia Gasparotto. Chapter 3 “Opening process” on contents” and subchapter “4.2 Elements for constructing experiences” are to be attributed to Alessandra Bosco. Chapter 4. “Opening process” on user experience” and “4.1 Elements of interface exploration” are to be attributed to Silvia Gasparotto. The Conclusions were jointly written by the three authors.

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Intercultural Design Approach. Narrative Design for a Multicultural Society

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Abstract

As part of an increasingly multicultural society issues concerning integration and relationships between ethnic groups and different communities are receiving a great deal of attention in the social and scientific debate.

The skills of design can be made available as a tool to systematise this multiplicity, promoting an innovation respectful of diversity, comparison, and interaction between people and cultures.

This article concerns practical product design applications, that explore the relationship between multi-cultural society and cultural accessibility. Moreover, this contribution aims to reflect on which and how methodological strategies could be implemented within a design process that focuses on an intercultural approach.

A series of case studies of narrative artifacts capable of bringing different cultures together and making them recognizable to different users will be analysed with the lens proposed in the methodological overview.

Keywords

Multicultural society
Intercultural design
Culture-driven design
Narrative products
Cultural identity

Stretching into the Mediterranean Sea, as a bridge between Europe and Africa, Italy has always been a land of migration, due to its peculiar geographical position, resulting one of the major countries for individual registration of new asylum seekers in Europe and in the world (UNHCR, 2022).

Then, as part of an increasingly multicultural society with a wide variety of lifestyles and cultural backgrounds – where the intertwining of lives and stories shape the territory and its material culture – issues concerning integration and relationships between ethnic groups and different communities are the subject of much attention in social and scientific debate. Especially in a society with a high level of immigration as in Italy¹, cultural diversity leads to new perspectives and new directions in different cultural fields, such as education, political and research agendas, museums (Nemo, 2015), art and design discipline.

As a result, a proactive way of thinking is required to create communication channels able to give value to people's experiences in relation to the territories they inhabit and their personal cultural identity. Identities that reflect a multitude of collective experiences, memories, and references that evolve constantly (UNESCO, 2009).

From a designing point of view, the rapidity and inexorability of these social changes impose an adaptation of educational and design practices, in order to effectively adapt accessibility policies aimed at the inclusion (social, cultural and economic) of people with a migrant background within territorial contexts often characterised by cognitive, affective and relational dynamics extremely dissimilar to personal cultural identities. In this context, the discipline of design can find diverse fields of experimentation and challenge, aiming to contribute through an aware and culturally evolved action able to narrate diversities, preserve identities and transfer knowledge through the objects that surround us "as a means to establish meaningful and emotional interactions" (De Mendeiros, 2014, p. 16).

Indeed, intercultural factors become important issues for the design field in the global and local economy (Lin et al., 2007), especially in the development of new products and services and in the definition of widespread graphic interfaces.

The skills of design can be made available as a tool to systematise this multiplicity, promoting an innovation respectful of diversity, comparison, and interaction between people and cultures Fig. 1².

Regarding the many levels of action at which design operates, it is possible to consider a wide variety of design contexts, including products, services, and strategies - not always strictly separated - for which design assumes the role of a multidimensional operational tool (Dal Palù et al., 2018).

Many of the products we use in our daily lives allow us to perform functions and satisfy needs in a various way related to different places and cultures, but performing similar experiences. Artefacts made from a local or global availability of materials and manufacturing techniques that have specific variations in different contexts, handed down over time and generations. Products, materials, and techniques, starting therefore from a common matrix, find specific declinations and create different traditions and customs.

1

According to the Atlas of migration, a report edited by the European Union offices, Italy in the last decades experienced strong immigration flows, resulting in approximately 5 million foreigners living in the country (Tarchi et al., 2021).

2

Fig. 01 provides a graphic summary of several potential design initiatives for cultural accessibility that involve various intervention scales. Although it is by no means a complete list, it illustrates the variety of tasks that a designer might investigate and include in its approach.

The meanings that products assume need to be read in the process of dialogue between culture, design, and users (Moalosi & Popovic, 2006). This might enable designers to develop products that fit the cultural context of their users and translate and simplify the multiplicity of narratives and stories present in specific multicultural scenarios.

And in this perspective, it can be observed how a kind of new designer figure is emerging: an *intercultural-mediator designer*, able, by collaborating with figures from the social sciences, to navigate cultural complexities and create spaces of design interaction between one's own culture and foreign cultures, working on their mutual influence in the form of acquisition, fusion and overlapping³ (Nemo, 2016).

In an interesting analysis developed by Jan Carel Diehl in 2006, the influence of culture on product design comes to the fore in many aspects, which can be categorised into two main groups: practical and theoretical Fig. 2. In his study, he distinguishes seven areas regarding cultural diversity that can influence the development process of product design. The practical group is made up of elements related to the design process (methodology, procedures), design education (transfer of design knowledge among other cultures), strategic (business strategy and product marketing in other cultures), and designers (cultural influences on the designer himself). It is substantially based on the physical interaction between products and contexts (De Mendeiros, 2014). The theoretical group is made up of the elements of aesthetics (preference for design in different cultures), semantics (interpretation of design and function) and human-product interaction (the actual use of products in different cultures).

Methodology

Starting from the theoretical framework outlined by Diehl, the reflections explored in this contribution, which is part of an ongoing Ph.D. research project, concern practical product design applications, that explore the relationship between multicultural society and cultural accessibility, especially using an intercultural approach – a social transformative perspective that investigates the points of interaction between different cultures and tries to create new narratives around them. Moreover, we intend to propose a methodological strategy to be implemented within a design process that focuses on an intercultural approach⁴.

The development of this approach consists, given a design topic, in extracting distinctive *intercultural markers*⁵ from specific cultural contexts and then translating these characteristics into highly representative products or services (Lin et al., 2007). Starting from these reflections, we try to define a possible methodological process Fig. 3 that allows designers to develop effective intercultural projects.

Indeed, the designer within these processes assumes the role (direct or indirect) of a “pro-active mediator” of knowledge and experience: a facilitator capable, by collaborating with other disciplinary figures involved, of navigating cultural complexities and creating “safe spaces” (Bustamante Duarte et al., 2021) of interaction - participatory and iterative - during the entire design development cycle.

3

Boundaries between cultures are continuously being relativised and redrawn. According to the concept of interculturality, intercultural dialogue between two or more cultures in society is characterised by mutual understanding and respect, which results in mutual influence (Nemo, 2016).

4

In this contribution we try to stress the difference between cross-cultural and intercultural design. The term *cross-cultural* refers to “the communication process that is comparative in nature” (Ting-Toomey, 1999). This approach, more investigated also from a methodological point of view, underlines the differences between cultures adapting the design choices to these diverse features. The term *intercultural*, instead, refers to the interactive “communication process between members of different cultural communities” (Ting-Toomey, 1999). It focuses more on the reciprocal exchange of ideas and cultural norms. It is a more active and social transformative perspective that investigates the points of interaction between different cultures and creates a new design narrative around them.

5

The *intercultural markers* are elements that are most prevalent within a particular cultural group and are considered surprising and remarkable by another cultural group (Bruno et al., 2012). Such as aspects related to appearance, modes of interaction, associated values and meanings, rituality, material culture, gestures, functional and behavioural factors, etc.

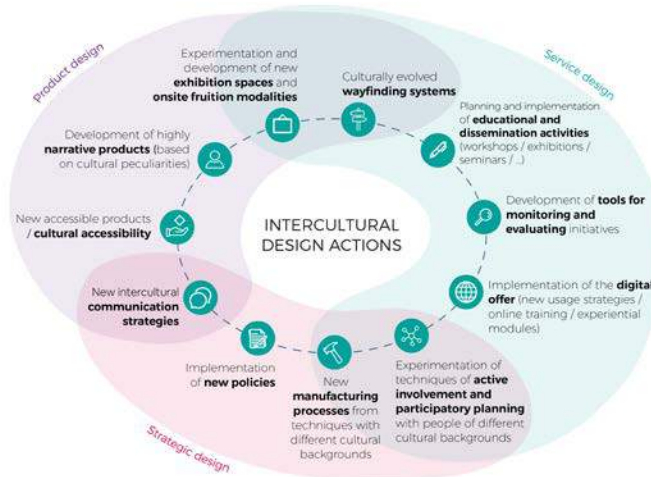


Fig. 1

Fig. 1 Possible intercultural design actions. Credits: authors.

Fig. 2 Mapping of areas on cultural diversity and design, 2006. Credits: Jan Carel Diehl.

Fig. 3 Methodological approach. Credits: authors.

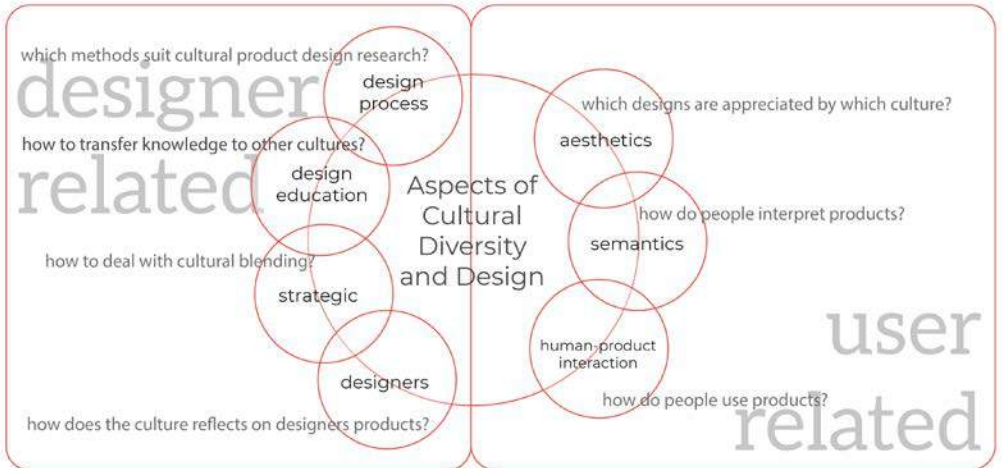


Fig. 2

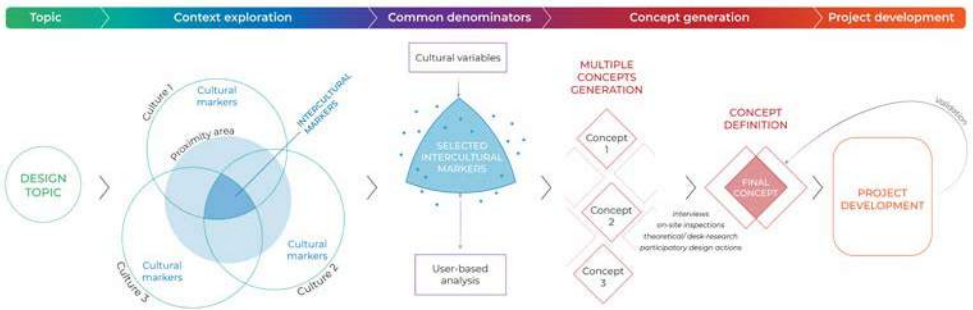


Fig. 3

And in the activation of these processes capable of generating projects that are aware of and truly based on intercultural dialogue - understood as a reciprocal exchange of skills and expectations - the technical actions of involvement and inclusive approach typical of Participatory Design (Binder et al., 2012), as well as the adoption of certain qualitative methods derived from social research, come to the aid of these processes⁶.

The current considerations, developed by combining a review of existing literature related to intercultural design, are prevalently applied to the graphic communication sector (for instance, Lipton, 2002; McMullen, 2016; Radtke, 2021). This essay intends to extend these reflections to the field of product design, thus creating a more inclusive approach that seeks to embrace different scales of design intervention.

Context exploration. First of all, a careful analysis of the contexts and the stories related to the identified topic needs to be implemented, also mapping and analysing international case studies, where necessary, alongside the territorial analysis. The creation of this basic framework is essential to understand the subjective interpretations and the social role of the possible cultural behaviours referred to some specific elements present in the environment and to adequately know some key principles shared by the cultures that cohabit a specific area in order not to fall into conceptual blunders. Regarding the overall scenario, it would be important to be able to create a cross-disciplinary research approach (Muratowsky, 2016), involving other skills alongside that of design, such as sociologists and anthropologists, in order to be able to define a coherent and complete requirement system.

Common denominators. The second step consists in the identification of a common denominator system, which is represented both by the cultural markers (tangible, intangible or behavioural) shared by two or more cultures analysed – the aforementioned *intercultural* markers – but also by all those which, although similar in certain respects, take on nuances of meaning depending on the culture of reference (elements that we could place within an “area of proximity”). Based on these cultural features, in the construction of this scenario should be considered the overall environment such as economic and social issues, as well as the technologies available.

The different meanings that the identified cultural markers assume in the context of different cultures and the related social implications were further investigated. In this analysis, the designer needs to pay close attention to social and cultural variables that can radically influence the outcomes of the project, such as differences in behaviour, outlook, and values between people from different societies or cultural groups⁷.

So, based on the defined scenario and the relevant element extracted from the intersection and the connections between different cultural features, this step focuses also on a user-based analysis to explore the interaction between culture and technology, dialogue between users and designers, and understanding the user’s needs related to the cultural environment.

6

Such as, for instance, participant observation, discursive interviewing, and focus groups (Dovigo, 2005).

7

G. Hofstede (1984) proposed four dimensions on which the differences among national cultures can be understood: Individualism, Power Distance, Uncertainty Avoidance and Masculinity. Furthermore, E. Meyer (2014), analysing how culture influences international business collaborations, has identified eight independent dimensions through which cultural differences can be conceptualized: Communicating, Evaluating, Persuading, Leading, Deciding, Trusting, Disagreeing and Scheduling.

Concept generation. This stage consists of the development of different conceptual responses through the definition of possible solutions and approaches through theoretical research, interviews, on-site inspections (where needed), feedback, discussions, participatory design actions. These concepts arise from the various combinations of the different intercultural markers, as defined in the previous steps.

Project development. Once the most representative concept has been defined, the project development starts, so from the preliminary design to the execution phase. In this methodological step, the quality check of the project (validation process) is also initiated by comparing the performances offered with the requirement system.

This re-evaluation operation allows finally to define the more appropriated concept – or a combination of some of them – and to start the development phase of the design process. This requires an understanding of how other cultures interpret images, layouts, colours, symbols, forms, textures, patterns, and other symbolic elements (McMullen, 2016).

Discussion about Intercultural Experiments in product design

The material and immaterial culture of a specific community, however, although rooted, is not a static entity, whose symbolic systems are limited to crystallizing into timeless objects.

A world in motion, made up of human migrations and shifting, also brings with its repercussions on value systems, on daily dynamics, and also on the world of design.

Humans carry with them their intangible assets, their world-views and, in some cases, even some objects of daily or symbolic use. Italy, and more in general the Mediterranean basin, has always played a crucial role in this scenario, as a middle sea and a place of exchange and confrontation (Tosi et al., 2015).

In this section, we will discuss some case studies of intercultural projects to reflect on the strategies and approaches applied by designers, who internalize values and meanings of cultural contexts and try to redesign traditional objects from their point of view.

We decided to adopt a qualitative research framework, collecting data from various documentary sources (research articles, project reports, official designer websites, etc). It has been limited to a specific sector that seems to be almost “naturally” suited to intercultural experiments: the food topic.

The design *about* and *for* food should be expected to play a prominent role also in cultural and intercultural processes: food and eating are symbolical parts of a social system, they address rituals and belief systems (Bruns et al., 2021). They represent a valuable opportunity for the exchange of memories, knowledge, and stories, as well as for the development of intercultural skills. Through the analysis of cultural habits and consumption practices, it is possible to understand a series of meanings associated with the production of identities, the establishment, and maintenance of social relationships, as the cultural changes in society.

A series of case studies of narrative artifacts capable of bringing different cultures together and making them recognizable to different users were analysed with the lens proposed in the methodological overview, in order to reflect if this approach can be considered effective and scalable to different areas of intervention. They were collected and analysed and categorized according to four macro-categories corresponding to different scales of intervention (material hybridisation, production processes, gestures and rituals combination, merging of preparation methods) Fig. 4.

Some of these analysed case studies will be discussed below to evaluate their effectiveness and the type of design operation implemented Fig. 5.

The first project is *Mest*, a Turkish coffee service that sees an explicit conceptual material hybridisation between ceramic and copper, belonging to two different material cultures of coffee preparation - one more Middle Eastern/North African and one more European.

The *ibrik*, the chiselling of the cups (*zarf*), and all the accessories associated with the service and the typical preparation of Turkish coffee are usually produced in copper and brass, materials that are widely used due to the great experience of Anatolian artisans in the handcrafted production of tableware.

On the contrary, it is quite unusual in European countries to see these materials used in coffee preparation, where instead ceramics are widely used: a clear example is the coffee cup (*demitasse*), produced in this material almost throughout Europe.

Also from a value perspective, the project focuses on the common rituals associated with coffee consumption in Middle Eastern/North African and European countries, traditionally connected with meanings of sharing and hospitality (Oğut, 2009). Moreover, the material culture associated with coffee and the variety of experiences created around it establish strong and lasting bonds between users, both on a rational and emotional level (Chapman, 2005), generating a sense of belonging and continuity between the individual and the group, as well as between present and past (Ozge, 2012).

Another project is *Me - dinner set*, a versatile set of mobile kitchen equipment for food preparation and transportation during picnics, resulting from a collaborative exchange programme between international designers, the MTic-design⁸.

The concept is based on the identification of a common leisure activity (the picnic) between the Dutch and Colombian cultures.

Indeed in Colombia, the picnic is associated with a tradition, particularly prevalent in rural areas, called the "Pot Gathering" ("*Paseo del holla*"). This popular ritual encourages Colombian families to gather by the local river and share the traditional Colombian dish: *sancocho*, which is usually prepared on-site, as are many of the dishes consumed during this event.

Differently in the Netherlands, picnics, which are very popular as soon as summer arrives, are mainly practised inside city parks - often in conjunction with certain festivals: cooking with an open flame is not always allowed in these public places, except in special barbecue areas. The *Me* project brings together these different rituals and ways of preparing picnics - the Colombian way of bringing

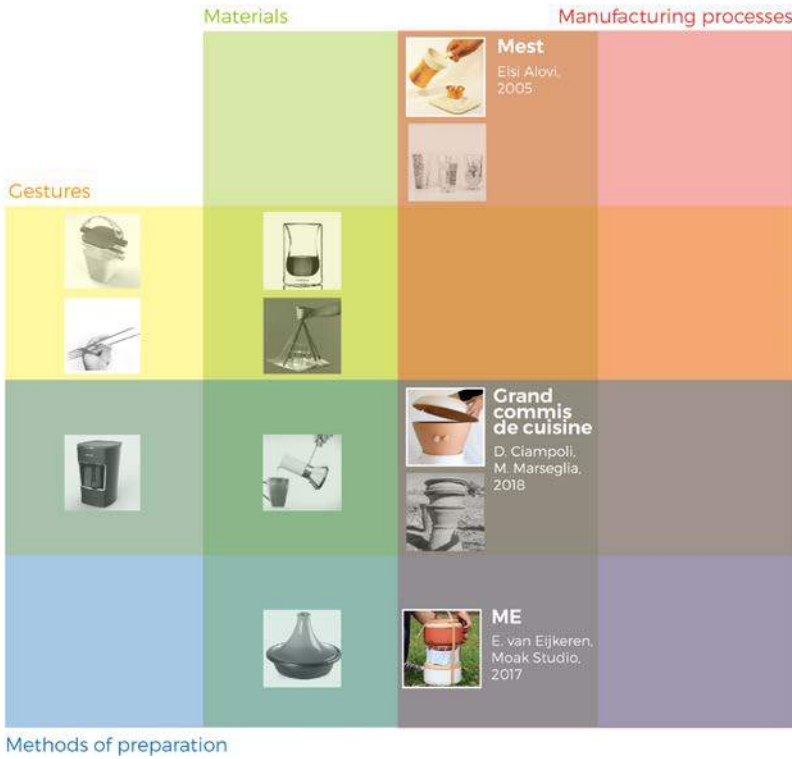


Fig. 4



Fig. 5

Fig. 4
Collection and categorization of the various case studies analysed. Credits: authors.

Fig. 5
Selected case studies: Mest (Elsi Alovi, 2005), ME-dinner set (Emma van Eijkeren, Moak Studio, 2017), Grand Commis de Cuisine (Daniela Ciampoli, Marco Marsiglia, 2018). Credits: authors.

food to cook and the Dutch way of bringing everything ready-made – and creates a set in which it is possible both to have a small grill in a small, controlled space, and to bring along food that has already been prepared beforehand.

Another case study is *Grand Commis de Cuisine*, a couscous-pot born as part of an Italy-Morocco cooperation project, aimed at enhancing the craftsmanship of the two countries (Ciampoli & Marseglia, 2018). Couscous is a particular dish, widely consumed in both cultures and with strong material and symbolic value of aggregation, sharing and a sense of community.

From the analysis of the traditional way of preparing Moroccan couscous, by steaming and not by direct absorption of water, a design phase began aimed at the formal and functional identification of an object suitable both for this preparation and for the most common ways of serving at the table. The couscous pot designed is composed of three elements: a basic pot in which to cook meat or fish and vegetables, a bowl in which to steam the couscous, perforated at the bottom to allow the steam to rise and flavour it, and a lid functioning as a serving dish.

The strength of this project, however, lies in the designers' attempt to create a blend of production processes and materials from the two countries. The production phase was entrusted to an Italian ceramics craftsman, Alfredo Quaranta, who, guided by Italian and Moroccan designers, experimented with a hybridisation of decorative and formal devices from the two cultures.

Conclusions

In conclusion, the extensive literature linked to culture-driven design and the examples reported here show how the realm of food represents one of those particularly effective areas for the construction of an intercultural narrative.

In general, however, following the analysis of the case studies, it emerges that product design experimentations within this theme are still in their nascent stage and that there is certainly still a long way to go to achieve design maturity.

The examples proposed present obvious limits in terms of the depth of the design action. The experiments are presented as more *cross-cultural* than *intercultural*: hybridisation occurs mainly through the “juxtaposition” of elements (material or process) from territories with different cultural backgrounds rather than proposing true and coherent design reworkings. They appear more as speculative design operations: with their intrinsic value in terms of critical analysis and initiation of research reflections, but which at the same time do not necessarily respond to real territorial and social needs.

This paper aims to provide a first methodological approach to be applied in the field of intercultural design, paving the way for reflections on the possible design actions on this peculiar topic: experimenting, for example, new ways of preparing food, new ritual, new participatory actions of culinary hybridisation, new strategies of cultural dissemination, new utensils, etc.

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It is intended that the methodology proposed in this paper – which is under development with a view to being verified, tested and refined – also has an educational potential in the perspective of defining a new figure of *intercultural-mediator designer*.

Certainly, the practice of learning, improving, and applying this methodology also needs to evolve and develop in response to the changing of cultural and global trends. (Lee & Bain, 2016)

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From Wayfinding to Placefinding Orientation and Alterity in Urban Spaces

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Abstract

In the semiotic theory, the city is considered as a text, a weaving made of practices, ideas, discourses. This leads to questions about the dialectic between identity and alterity, which is often left aside by the design theories, that mainly focus on identity. What we call 'identity of a place' is its ability to synthesize the diversities that populate it. This paper presents some reflections based on the following scientific hypothesis: the in-depth study of orientation systems can also lead to the definition of the character of an urban space. Orientation systems should be thought not only to help people finding their destination, but also to build the user's mental image of that place, making it recognizable and identifiable. The first objective of the research is to question both the environmental complexity and the cultural multiplicity of a place. To reach this objective, the adopted methodology has been the observation and analysis of an urban area in Rome, Ostiense.

Keywords

Wayfinding
Urban space
Semiotic
Alterity
Cultures

Introduction

For the purpose of this research, we decided to take into account wayfinding systems as a possible tool to communicate the plurality of a place.

Globalization and migration flows are increasingly putting the identity of our cities to the test. It is an identity that, however defended and cared for, constantly enters into relation with various forms of alterity: those of people coming from other countries, those of the homeless, those of the younger generations who enter into dialectical conflict with the older ones, those of tourists and temporary visitors, and others. These alterities do not always or necessarily remain in a state of strangeness in the new places where they find themselves. Often, they integrate, albeit with difficulty, other times they experience conflicts, especially out of xenophobia, but triggering processes of social reorganization. Cultures of origin bring new values and new perspectives, which, even when they are not well received, pose questions and generate curiosity.

This means that design – in particular communication and service design – must increasingly think of itself as *design in alterity*: a practice of design and the production of ideas acting within an increasingly complex cultural plurality. Which not only cannot be ignored but can become the very purpose of design (cf. Zingale, 2022).

Explicit orientation systems are indeed called upon to consider the variety of supra-linguistic and supra-cultural languages and communication customs. But there may also be environmental communication elements that influence orientation, such as the colouring of buildings, paving, shop signs, and buildings that take on the function of landmarks. One must then consider the various sign traces that the inhabitants of a city leave behind, such as graffiti, improvised signage, commemorative plaques, and temporary or permanent affixes (Marrone & Pezzini, 2006; Marrone, 2009). This *implicit wayfinding* also fully affects the tensions between the identity of places and the otherness of the subjects who inhabit or visit them.

Wayfinding and Placefinding

This goes beyond the definition of wayfinding system as a set of signs helpful to reach a destination and mainly related to a graphical dimension, to move towards a more comprehensive understanding of the terms as a spatial problem solving activity, embracing a series of different disciplines, from psychology to architecture, from semiotic to design (Arthur & Passini, 1992; Passini, 1996; Golledge, 1999; Berger, 2005; Mollerup, 2005). *To orientate oneself* does not mean only *to find the way*, but also to feel a sense of belonging to the place, to feel it as familiar and not as a stranger. Orientation systems, in other words, should be thought not only to help people finding the right way to their destination but also to help them in understanding in which way the surrounding environment is built, being part of the imageability of a place (Lynch, 1960), and in our case of an urban public place.

In other words, orientation concerns not only the physical and spatial dimension, but also the ability to read and interpret the urban environment and the artefacts that, explicitly or implicitly, play a com-

municative role. *To orientate*, in this sense, means moving from the unfamiliar to the familiar, from doubt to certainty, from the opaque to the sharp. In other words, and adopting a slogan from Ugo La Pietra (2019), to orient oneself means to feel at home everywhere. It is thus a question of placing the user in a situation of cognitive and psychological well-being, which can be achieved if perceptive well-being (which concerns sensory enjoyment) and semiotic well-being (which concerns interpretation and comprehension) are offered first.

Wayfinding systems are also helpful in building the user's mental image of a place, making those places recognizable and identifiable, in a process that we can define as *placefinding* more than *wayfinding*. It is in fact a *place*, that is, the physical and architectural space that has somehow become *inhabitable*, that we seek; a place that enables the harmony between ego-centered *space* (my space, the immediate object of my interpretation) and *social space* (our space, the space as we all tend to interpret it). Therefore, considering the process of re-appropriation of urban public places by the citizens (Manzini, 2021), and by any other kind of users, the involvement of wayfinding systems as information systems about the place, as *placefinding*, can have a role in expressing the cultural multiplicity of an urban space and in making it more livable. To go deeper in this direction, we decided to start by focusing on a specific urban place in which to operate. The first step of this path is to understand the chosen place in all its diversities to then try to find a way to highlight the existing plurality through wayfinding systems.i

Methodology

In this paper we mainly focus on the analysis of an urban place, approaching it from the semiotic perspective of the textuality and considering it as an interweaving of practices, ideas, discourses (Vulli, 2008). In order to analyze the chosen urban area we decided to use a qualitative approach (Creswell, 2013) and in particular an ethnosemiotic methodology, which links the ethnographic methods of observation with the semiotics tools, capable of playing an important function in understanding the observed phenomenon and building its structure (Accardo, Liborio, Marsciani, 2015; Donatiello & Mazzarino, 2017; Lancioni & Marsciani, 2007) with the aim of gaining awareness about the relationships between the actors and the objects involved, in their own context with an eye at the possible design implications (Galofaro, 2020).

The phases of the research

For the purpose of this research, the work has been divided mainly in two phases: the work off site and the work on the field.

Off-site analysis

The off-site work starts with the identification of the place to be studied to then proceed with a desk-research analysis helpful to

better understand the area from outside, both from a structural and a cultural perspective. To start understanding the cultural background of the area some of the aspects to be studied from outside are: the history of the place, in terms of urbanizations and development of its population; the narratives that each site produces over time; the perception from the media (Gamba & Cattacin, 2021). To study its physical structure, we decide to rely on Lynch's five elements of the city (Lynch, 1960). Paths, nodes, edges, areas and landmarks can give us a first structural overview. Their identification starts by analyzing the plan view, to then verify them through our point of view, as observers walking around that city, and through the point of view of the people living that space (Stevens, 2006). This leads us to the next step: the work on the field.

Work on the field

Once some understandings of the place are gained through the off-site analysis, the work on the field can start. It can be divided mainly in two steps, comprising of different actions. The first step is a systematic site inspection (Lynch, 1960), in which the observation is the core part. To observe is the way to better understand not only the physical structure of the place but also the interaction of the people with it, from a phenomenological perspective. The aim of this step is to describe the meaning for individuals of their lived experiences with the surrounding environment (Creswell, 2013). To do so, the second step of this phase is also necessary: the involvement of the people. Since wayfinding is something with which everyone deals in their life (Zingale, 2012), the people involved should be a wider expression of the population that they represent: people living in that place since a long time, people who just moved there, people who go there just to work. This is the participative part of the process in which people are not seen as users with defined problems to be solved but more as active participants in the design process able to bring competences and knowledges to the process (Manzini & Staszowski, 2013) and to give voice to the complexity and cultural multiplicity of the area (Pezzini, 2008; Tani, 2008). All the activities carried on in the different steps will be used to build a consistent understanding of the place from the knowledges gained both through the site inspections and through the interactions with the people. The result would be a detailed description, both textual and visual, useful to interpret the results obtained in the previous phases (Gray, 2004) and to address the overarching objectives of the research.

First understandings: Ostiense area in Rome

To the purpose of this research, two different areas will be studied, to have a broader and more accurate result, but, in this paper, we will deepen just one of them. We first defined that the area of interest had to be: part of a metropolitan area, but not necessarily identified as a neighborhood; subject to cultural, architectural or economical changes through the last years; populated by different

groups of people, in terms of age, sex and cultural background. We first identified the two metropolitan areas of Rome and Milan, being the two main cities in Italy, to then narrow down to a smaller area for each city. It is difficult to define the boundaries within which to operate, but for purposes of the research it was necessary to circumscribe the area of action according to the way of living and perceiving the place (Donatiello, 2017). Through a framework of characteristic, the area around the first kilometers of Via Ostiense in Rome has been chosen Fig. 1.

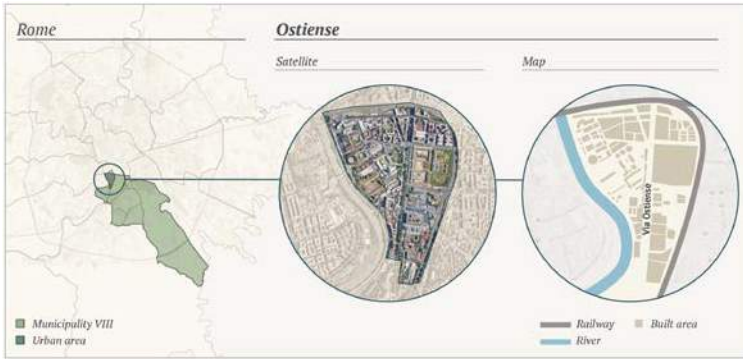


Fig. 1
The localization of the chosen area, Ostiense, on the map of Rome, its aerial view from Google map and its schematization. Credits: Daniela D'Avanzo and Google Maps.

Off-site analysis: the history of the place

Via Ostiense, one of the most important streets in Rome, connects the city to the seaside of Ostia, from which it takes its name. According to the Rome Municipality, the chosen area is part of the VIII Municipality, administratively speaking, of the urban area 11A, urbanistically speaking and of the Ostiense district, toponymically speaking. The chosen area, shaped like an upside-down triangle, is well defined by structural edges that on the western side overlap with the river Tiber and on the other two sides overlap with the railway trails. For this reason, it also has some very strong access points, like bridges and underpasses.

Starting from an historical analysis the first thing that arise is its strong industrial vocation due to the establishment, in the first part of the last century, of several different industries and related activities such as: the river harbor, the general market, the electricity powerplant and the gas implant Fig. 2. All of them are still present on the territory but they are living a process of change of use. For instance, the old powerplant is now part of the Capitoline Museums known as Centrale Montemartini, a former military depot is now a housing squat with a strong street art intervention on it Fig. 3, old industrial buildings are now hosting a university. This process of re-semanticization of the places is one of the reasons that makes this area interesting for the purpose of this research, pointing out the stratification of different meanings for the same place trough time. These first understandings have been helpful to identify the main structural elements of the area on the map, such as paths, nodes and landmarks (Lynch, 1960) – the other two elements being already defined are not taken into consideration in this phase – to be then verified on-site.



Fig. 2
The gas implant (Gazometro) is one of the main landmarks of the Ostiense area. Credits: Daniela D'Avanzo.



Fig. 3
The street art intervention of the artist Blu on a housing squat in a former military depot, this building is another important landmark of the Ostiense area. Credits: Daniela D'Avanzo.

On-site analysis: site inspections and observation

The information collected off site was then used to explore the area on site, going in those places to observe, take notes and pictures. The first site inspections were left free and random, in order to have a broader overview on the area. This initial freedom of action left space to the rising of some questions mainly related to the proper way to conduct the observation and to the definition of the object of the observation itself. Through these questions the need of a systematization of the inspections became more evident. So, the first off-site understandings were helpful to start narrowing down the

objects of the observation and to identify some thematic paths to be followed on site, such as: the construction materials used, pointing out both the historical industrial vocation and the contemporary modernity of the area Fig. 4; the street art, strongly present in the area with both spontaneous and planned interventions; the green areas, on the contrary very marginally present in the area; the wayfinding attempts Fig. 5, mostly left to institutional and bureaucratic practice, often self-referential and far away from the anthropological and semiotic complexity. All these thematic paths have been followed through new site inspections mainly conducted on foot, in different hours of the day and in different days of the week, with the aim of searching for traces on site and to record them by taking photos and notes. Through these more systematical site inspections some other questions arose, mainly related to the way in which all these elements were related to and perceived by the inhabitants and users of the area. For this reason, going around in the area, another unavoidable focus of observation were the people and their interaction with the space Fig. 6. In this case as well, the first contacts were random and spontaneous: observation from far away, pictures taken from distance and finally occasional small talks. As for the previous object of observation, a need for the systematization of the interactions with the people started to be more evident. This led to the definition of a set of questions to start collecting direct testimonies. The first interviews were aimed at understanding the way of living the area, whether as a frequent or occasional user, to then deepen the perception of the area itself through simple questions left open to initiate a wider conversation. The first interviews were conducted by choosing people who had been randomly met during the surveys and with whom casual contact had been made for different reasons related to the observed object. The answers pointed out very different ways of experiencing the area, from the old man who would like to have more services for elderly people, to the young workers who enjoy the way in which the neighborhood has evolved in the last years. All the testimonies were collected to start creating a picture of the situation, that because of the complexity it represents, has shown the need of further deepening with new interviews and inspections.



Fig. 4
The contrast among the materials used for the constructions alongside the graffiti painted highlight both the industrial and contemporary mood of the area. Credits: Daniela D'Avanzo.



Fig. 5
Wayfinding attempts: one of the identification signs, part of the wayfinding system for the Outdoor Urban Art Festival 2011. Credits: Daniela D'Avanzo.



Fig. 6
Two different places of aggregation for young and old people – the university and one of the historical bars of the area – where it is easy to create connections with different kind of users of the area. Credits: Daniela D'Avanzo.

Further actions

This phase of the analysis became an iterative process: the first site inspections were useful to develop hypotheses about the place later verified or disproved by the people. In this perspective the further site inspections as well as the planned further interviews, will be helpful in order to have confirmation or to rephrase the first hypotheses and to set further actions in a process that will converge in a detailed descriptive analysis.

Conclusions

These first understandings started to create a picture of the area that step by step became more complex. The plurality of the place started to emerge, both from a structural perspective and from a cultural perspective, allowing new understandings of the place to emerge. The interpretation of the behaviors, of the actions and of the ways of being of the people, will lead to cultural and symbolic comprehension of their value both for the people and for the community (Lancioni & Marsciani, 2007).

These first understandings will lead to a better comprehension of the plurality of the place through the deepening of the relationships between the people and the place itself, highlighting not just one common meaning of the place but several meanings according to the living experience of the people. Further actions will be then planned to position this diversity as a richness for the place itself and to understand in which way wayfinding systems, as *placefinding systems* and as a tool of design for alterity, can have a role in this process.

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A Meta-Analysis for an Interactive, Intersectional and Inclusive Exhibition Based on the SDGs

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Abstract

The main goal of the project is to create an interactive exhibition, innovative and technological in its approach, that aims to create awareness and promote the knowledge of the Sustainable Development Goals of the Agenda ONU 2030 – in particular, on the value of social and environmental sustainability. 178 Countries adopted a common agenda to preserve our planet for the first time in 1992, during the Rio de Janeiro Summit. From that moment, the concept of sustainability has changed forever and has been changing ever since. In this paper, after understanding the state of the art in the field of the interactive exhibition, it is going to be explained how the methodology is applied in order to evolve from a desk and field analysis to a concept definition. These key points will then help define the concept in the shape of an operative strategy with methodological guidelines and a structured solution. From this stage, a few considerations on the future of this proposal can be drawn.

Keywords

SDGs

Exhibition

Social and Environmental Impact

Systemic Innovation Design

Methodology

Project Management

Introduction

The purpose of this paper is to describe the process that allowed us to create an interactive exhibition based on some of the themes promoted by those SDGs that are focused on social themes, to sensitise young adults to the issues.

The Sustainable Development Goals, also known as SDGs, are 17 macro-topics that include 169 targets and more than 240 indicators. They set out a shared global agenda for human development that is fair, inclusive, and sustainable (UN Agenda, 2015).

The principal SDGs oriented in social matters are the fifth – “Gender equality” – and the tenth – “Reduce inequalities”. These main two can be supported by others like the first – “No poverty” –, the sixteen – “Peace, justice and strong institutions” – and the seventeen – “Partnership for the goals”. By delving into these goals, it is possible to underline some crucial topics in the different targets. Particularly from gender equality, we can highlight issues like equal opportunity in leadership roles or the need to eliminate all forms of violence against all women. From this, it is possible to shape even more different and specific topics to tackle. The goals of reducing inequalities are focused on social, political, and economic issues concerning everyone regardless of age, sex, disability, race, ethnicity, origin, religion, social status, or otherwise. It focuses in particular on the needs of developing countries, or those areas affected by unsafe migration.

These decisions defined the direction of the following steps. It helped in the research of case studies, grandly having a background of knowledge and inspiration (Tamborrini, 2017). Therefore, it is possible to convey a survey for a wide-public range or even more specific question that has the purpose of inclusivity and better comprehension.

State of the art

The first step has been the analysis of the state of the art, based on a selection of installations with an eye on how social matters are dealt with and how the interaction is built in the exhibits’ framework (Panafino, 2012). This step was translated into the analysis of some case studies like exhibitions, installations and artwork on social inclusions and related topics. In particular, the research was built upon two criteria, and each case study had to meet at least one element for each of them.

The first is related to the topic, which had to deal with inequality issues. According to the previously made analysis, it has to include aspects of gender balance (Hauspie, 2023) in order to provide a past or prevent view on the selected topic, especially considering specific related topics as gender discrimination, glass ceiling or gender pay gap. Another aspect in the inequality criteria is the LGBTQIA+ topics including social, political and economic discrimination, equal rights and visibility (Nicol, 2018). And finally, the diversity valorisation, a sort of intersectional aspect (Adichie, 2014) which considers gender, sexual orientations, but also any disabilities or anything that can be considered different from the statistical norm (Sytsma et al., 2012).

The second criteria is related to the human interaction design of the case study. They had to be a relevant example of interaction, through analog or technology-based support. The case study can involve AI supports (Gaia et al., 2019) able to generate a direct human-exhibit interaction. Other supports can be completely analog (Vaudetti et al., 2014), but with a strong value on human engagement and interaction. Some other could have a blended modality — also known as phygital — able to interact with the user through physical element, in order to guide them into a digital environment (Di Salvo & Arcoraci, 2020).

This led to an overall picture of how this theme is discussed, perceived, and how much it is integrated with the technologies, as well as an acknowledgement of the existing interactions.

On a concrete level, the analysis already shows some good practices in representing social issues through static exhibitions, showing societal stigmas in unconventional manners. Both in *One Man Show* (Juvani, 2018) and *CECI N'EST PAS...* (Verhoeven, 2013) the show-cased taboos and social outcasts are portrayed in such a way the visitors tend to change their perspective of reality. Going in-depth, *One Man Show* expresses the struggle of toxic masculinity through practical installations made of concrete, metal and flowers, but also intimate videos of the human body and non-conforming clothes and make-up. Meanwhile, *CECI N'EST PAS* analyse the concept of social outcasts, placing ten people in a glass cage. The showcase of these people — that represent specific socially marginalised experiences, like children at war — is managed electronically through an automatic shutter that rises, creating shock, discomfort and reflection in the visitors.

Interactive exhibitions on social matters seem to exploit technology to build an intimate or even individual place rather than to convey a collectively meaningful message. For instance, *How We Act Together* (McCarthy, 2016), held in Schirn Kunsthalle, Frankfurt and Online, readjusts the meaning of social interaction gestures to rebuild an intimate space to find others. Through simple gestures made in front of a camera, the visitor can upload their animation, which is widespread among other visitors. This cascade effect of videos of the same gesture, with time, is creating discomfort even from common behaviours.

On the other side, those exhibitions which label themselves interactive use technology to build an immersive path into the thematic area. *A come Ambiente* (i.e., E for Environment) Museum in Turin uses simple interactions to allow primary to high school students to better understand environmental issues in a more concise and impactful way rather than words (MAca, n.d.). In detail, the museum includes digital as well as physical individual exhibits that touch a specific topic (e.g. water consumption, recycling processes or energy production). With the practical approach, the exhibits invite visitors to interact and learn directly from them.

One key characteristic that we found interestingly recurrent was the disturbing element in the exhibits.

At the same time, it clearly emerged the lack of technological interactive exhibitions designed to make social matters clearer by these innovative means rather than words, as happened in the last cluster of examples. This new element, that can be considered as a “wow effect” (Rodrigues et al., 2022), can be defined as that technology that is so innovative or advanced that has been never seen before, or if it is not technological, there is anyway an element that you would never expect from such a context. Indeed, just a few elements and examples were present, but the technology did not stand as a best practice when dealing with these topics.

When looking for exhibits and museums on different topics, it was easier to find technological elements playing a more relevant role. Still, in this case, it was often science itself being the centre of the topic.

For this reason, it was possible to find the first relevant issue: technology had to be a tool to deliver the strongest message possible (Bonnardel & Zenasni, 2010), but we shouldn't have focused on the technology itself just to reach the “wow effect”, or it would have become the main subject, derailing from the focus on the SDGs.

Therefore, the focus was directed toward the users, and their interactions, and the message was fundamental to be delivered (Baldwin et al., 2004).

Methodology

To provide an effective and concrete outcome in this case study, it has been necessary to define a well-structured methodology that settles down rules and boundaries into the design phases. For this reason, it has been considered the systemic and innovative holistic design methodology, in order to understand and define the needs of users and stakeholders and, finally, to provide fundamental guidelines for the design strategies. This analysis is going to deal with the first stages — the methodology selection and the state of the art — that guided the process toward the definition of a concept (Tamborrini, 2019). In the future, the other phases will be considered. Starting from the realisation of a brand identity with the design of a logo, the promotion of social pages and the development of an app. As well, the economic phase will take place with the design of a business model canvas (Osterwalder & Pigneur, 2010) to make such an exhibit a viable business opportunity to other external stakeholders. Finally, the designed and developed application can be integrated into the rest of the technological elements of the exhibitions Fig. 1.

The initial requirement in the design phase, has been to select a well-structured topic that considered and gave value to the Sustainable Developments Goals. This allowed the definition of boundaries, setting the framework in which the fundamental topics would be explored. Indeed, the focus has been set on social sustainable issues. This selection happened due to the low concern that is often given to these topics with respect to those more strictly related to the environmental dimension. More specifically, the tight link between the social

dimension and the environmental one and the boost that the former can give to the latter one is often overlooked. Therefore, this under investigated area of research was identified as of relevance for this research.

In addition to this, still in the brief phase, it is fundamental to consider possible stakeholders and practical partners who are possibly willing to join the development of the project, and then become partners or collaborators in the executive stages. In this phase, the collaboration with academic and institutional actors plays a significant role for their key and active role in shaping the changes needed to face sustainable social issues. At the same time, individual and corporate-based collaboration are of significant relevance both in terms of fostering support toward such topics and of the availability of resources.

A second moment in the design phase has been the definition of holistic analysis, which is represented in the design phase below. This step is crucial to define what has already been done on the specific topic, and what can still be done or improved. Moreover, the combination of qualitative and quantitative data defined a well-structured network of information that could be further analysed and used as a base for the definition of the project. Data were collected both in the field and through desk research. The former approach was based on both an online survey distributed through different channels, and by interviewing part of the respondents who were available to further discuss their opinions. The latter approach was carried out throughout the whole process rather than following the first one, and it was mainly based on the constant scanning of diverse sources with the major aim of trying to find a quantitative scale for measuring the positive and negative impacts and changes in terms of social issues. In addition, a close confrontation with experts in scientific, managerial, and social topics provided feedback in the confirmation of the direction of this project (Acocella, 2018). Again, this phase should not be conceived as an ex-post design activity — rather a continuous loop of “build-confrontation” — to discuss the most relevant decisions along the process as well as continuously trying to not overlook any dimension of the project.

The last step of the design phase has been the identification of personas, pointing out the major characteristics of the typical user. This step allowed the design to be user-centric, by allowing the definition of methodological guidelines to be always focused on the actual need of the users rather than on the imagined ones.

Eventually, from the drafted guidelines the project was defined in its all characteristics.

Analysis and Results

The online survey was distributed through the networks of the participants in the design phase. Quantitative data were gathered from a survey that involved 249 people older than 14 — aligned with the future exhibit target. It was relevant to note that although 73% of the respondents were not aware of the SDGs, the totality of the respondents showed great interest in the social topic. Specifically, when asked to rank different social issues in terms of urgency, respondents were most concerned about overarching problems such as “Ensure equal opportunities for everyone” and “Adopt social protection policies, for greater equality” rather than specific ones such as “Balance the gender pay gap”, thus showing how social issues are felt as urgent in their overall nature rather than in some of their specific aspects. Fig. 2.

Some of the respondents were further interviewed about their opinions about the term “equality” and their expectations from a possible exhibition dealing with such topics, often highlighting possible risks such as going into too many details on some topics when no common ground with users is set, taking a non-neutral standpoint on the storytelling, and thus not incentivising users to put themselves in the discussion, rather close the experience.

To complete the framework qualitatively, it was necessary to receive qualitative feedback on the direction taken and on the selected topics. For this reason, some experts, either in the social topic or in science dissemination, were interviewed.

Three of them focused their suggestion on the experience. Thus, the importance of highlighting the three components of each interaction, namely emotional, experimental, and scientific. To stress the emotional component, these issues should be felt as if they were close to the visitors, and not on the other side of the world. Specifically, experiences of stigma and marginalisation should be collected from people who really experience them every day in their life, leaving them on the floor to really explain what it is like to be marginalised. For this reason, some unique people —here called with fictitious names, to preserve anonymity — were engaged: Andrea, a trans guy who has shared his life on social media, and Francesca, a girl sharing on the media the problems of her chronic disease.

The other three interviews with communication experts turned out to highlight the difficulties in physically building the interaction and the technology itself. For instance, while acknowledging the importance of storytelling, a science communicator was concerned about the risks of written sections, as people tend not to read and miss the experience. But at the same time, using a technology-based experience limits the choice of available places; besides, overusing technology might mislead the message itself. Thus, the interplay between physical and digital interaction would be the best choice.

While the last interview was mostly focused on the drafting of a possible business model allowing the exhibition to be economically sustainable and thus be moved to different places, an important consideration emerged. Indeed, people are already aware of most of the topics of SDGs, even if they do not know them by name; indeed, a lot of sustainable initiatives are being shared within the corporate world. But one of the most innovative aspects of this new agenda is

the integration among all the objectives, acknowledging that one cannot be reached without also working on the others. Indeed, all the messages should strictly intertwine the objectives, not deal with them one by one.

Thanks to this analysis, it has been possible to define a series of personas —archetypal figures able to combine all the knowledge from the preview phase and that can represent the possible use of the project case study. These personas, then, are helpful to create user or customer journeys, additional tools that provide hypothetical results on human behaviours, stressful moments, and trigger points of feedback (Pannafino, 2012).

In the last phase, methodological guidelines are defined. They can be listed according to specific topics —such as materials, usability, interaction, technological implementation, economical constraints and many more— to create cluster consideration, needs and then possible suggestions for the future strategy, and so, the project itself.

From guidelines to Solutions

Considering the results achieved by analysing the State of the Art and the development of the methodology proposed, this solution is going to approach an innovative human-digital interaction to deliver in the best way the message. Before going in-depth into the solution, a few guidelines can be listed, summarising the previous analysis and setting a new starting point for the project.

The following guidelines can be subdivided into four areas: first, a *physical context* in which the exhibition must be flexible, transportable and modular, but also reproducible and inclusive; the second area includes the *technical aspect*, so the exhibit must be self-explanatory, integrated with affordable technological elements, gamified and integrated with social media; a third area includes the *final user*, the visitor —they are the central focus, they have to be amused, but also provide feedback; finally, the *economical area* has to be tackled — a low budget and the use of local resources are two important project guidelines.

Therefore, the innovation can be seen in this solution through a personal guide, a storytelling provider and gamified reality (McCausland, 2022). It is a digital guide useful not only in teaching, but also educating through a mutual growth process. The app can introduce time by time “pills of knowledge” that gravitate around social matters, but in such a personal way that the visitor will try to rely on it. In fact, it provides different activities for each exhibition, from Q&A sessions to personal questions, to direct explanations of the context in which the visitors are temporarily placed. Moreover, with all the answers provided by the user and the survey they would take, the app itself will be able to “update” the pattern of knowledge of the visitors, as well as their level of inclusivity and sensitization. This will give the chance to readapt some part of the digital side exhibit nearly in real-time, while by various iterations the physical exhibit can be made more accurate and up-to-date.

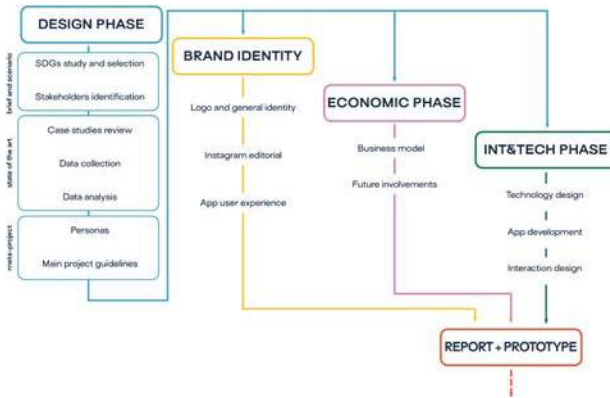


Fig. 1

Fig. 1
Methodology
Short description: Outline of the design methodology combined with a management-based approach
Acknowledgements: Designed by the authors



Fig. 2

Fig. 2
Desk analysis
Short description: Infographics on the main outcome of the research analysis based on a survey
Acknowledgements: Designed by the authors

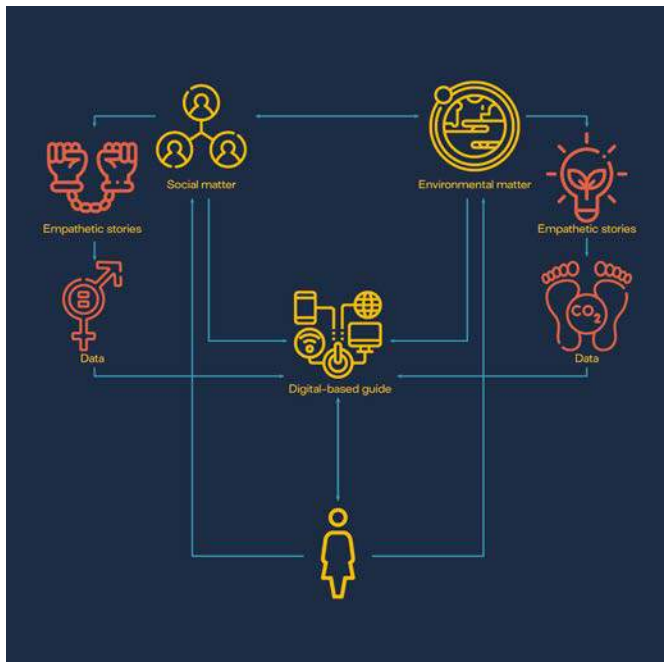


Fig. 3

Fig. 3
Interactive flow
Short description: A flow of the main interactions and topics that the exhibition project puts into effect
Acknowledgements: Designed by the authors

Moreover, creating different interactive narratives that, time by time, evolve and create a sort of “social real-life book”, made of real-life stories and real-life data, is a very effective way to engage the audience not just as a passive visitor, but more as an active actor (Danks et al., 2007). To talk properly about different topics that are gravitating around the idea of social and environmental sustainability, it is crucial to create stories and narrations that can define an empathic link between the visitor and the experience. This can set the mood for slow but important behavioural changes and knowledge provision, that in a “longue durée” can be at the base of a change of social paradigms (Braudel, 1967).

Finally, a tool used in combination with the idea of the personal guide and the inner storytelling is gamification. With the implementation of smart objects composed of physical components and digital interfaces — such as RFID tags — the interactive role of the user is guaranteed. Moreover, it activates the process of a real-life scenario, able to push even more the consciousness of the visitor in his actions, and so in the understanding of the experience (López-Martínez et al., 2020). In addition to that, the app itself has a strong role in the gamification process and, combined with the other sensorial experiences — e.g. LED lights, sounds and tact feeling —, completes the immersive experience of the entire exhibition.

Technological innovation might seem a linear but constant growth, but the use of it in such a disruptive way — especially combined with the value of the Sustainable Development Goals — sets the basis for a functional engagement with the user and effectively delivering the message, not focusing the visitor’s attention only on the technology itself but in the experience as a whole. Fig. 3

Results and conclusions

Since the birth of the Agenda 2030 and the definition of the Sustainable Development Goals by the United Nations, many events and activities have been developed and carried out in order to increase the awareness of all people. Nevertheless, most of those activities focus on environment-related SDGs. Human rights and equality of opportunity between all humans, regardless of their ethnicity, gender, or social status, are topics that are just as important and strictly related to the previous ones. Public demonstrations are fundamental to spreading unheard voices out loud but may not attract all sorts of people. The exhibition presented in this work wants to convey the same message in a different, complementary way, by raising awareness, informing and sensitising people through a short, structured path along with the main issues that the current state of the world is facing in the context of inequality and discrimination.

In conclusion, this research moves towards a practical project, a solution that wants to be a call to action for all *active subjects*. Even if the experimentation of the interactions has yet to be developed, tested and corrected in case, the project has a strong qualitative value and important visual outputs. Some functional mock-ups and

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prototypes have been created and presented to key stakeholders. In 15 minutes, ten people both from the academy and from other stakeholder groups could interact with the prototypes and assess the conveyed messages. However, due to the lack of time and space in the presentation, little data could be collected about the whole interactions with each exhibit, although some general feedback was provided. Indeed, the main features designed in each exhibit were effective in showing the key message of every exhibit, however, physical limitations due to the paper-based prototype did not allow further investigation of the dynamics of interactions. Several further considerations on such user-exhibit interactions and the dynamics of both actions and idea sharing would be suggested. There is confidence in the fact that the storytelling — that involves both social and environmental sustainability — managed in such an unusual, yet innovative way, is going to be an example of feasibility in the connection between technological innovations and human values.

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From Empathy to Inclusive Design: Multisensory Solutions for (Not Only) Socially Sustainable Projects

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Abstract

Solutions designed for specific niches have over time become integrated into common use, while others have remained the sole purview of small groups, defining and stigmatizing them. Through an analysis of the process that has made many technological solutions created for the disabled into common use for the majority, it is possible to understand when and how designers should intervene in creating their projects to guarantee the accessibility and usability of the resulting artefacts. There are ways to 'empathize' and consider users based on their general abilities and technological skills, so as to broaden the meaning and the sphere of accessibility. Deepening users' needs and ways of interacting, shaping 'personas' according to their abilities and not just difficulties, can help design more inclusively. This approach makes possible not only the scalability and inclusiveness of the end result but also of the design tools, focusing on specific needs without being exclusionary.

Keywords

**Design for all
Assistive vs Mainstream
Design thinking
Touchless**

From assistive to mainstream: designing for the few for the common benefit

Several technologies (both analogue and digital) designed to support vulnerable users have been integrated into *mainstream* use over time. Identifying and recognizing them allows us to examine the factors that made them so popular and used, and to reintroduce them. In this way, society may succeed in reducing the stigma towards objects created for disabilities thanks to the awareness and spread of widely usable devices. The knowledge that many traditional artefacts work on similar principles and technologies to those used specifically for users with disabilities is useful for end-users but primarily for designers. This opens the door to broad-spectrum solutions, those “that produce buildings, products and environments that are usable and effective for everyone, not just for people with disabilities” (Steenhout, 2010).

It is based on principles of sustainability and agility at a tangible and community level but also on the development of economic models able to bestow companies with a broader target audience, linking profitability to a social goal. Taking into account various disabilities and making users belonging to minorities part of the designing process is essential but cannot solve every problem on its own. Indeed, there is no point in this involvement if one always designs specifically and separately. This in fact tends to separate, while in many cases opportunities emerge to converge skills and needs on a large scale. There are such examples in everyday objects (e.g. curb cuts, proximity sensors in sinks and automatic doors,...), and devices or interaction systems related to aid or compensation for a disability, but also in the field of multimedia arts (e.g. voice synthesis and recognition, motion sensors,...), where immersive experiences are based on technologies that have a strong inclusive power precisely because they are already multimodal and multisensory (Delprino, 2022).

The designer's approach to inclusion is crucial, along with user familiarity and drive towards unity. “Design is much more likely to be the source of exclusion than inclusion” (Gilbert, 2019). The design process may, in many cases, create artefacts perfect for specific demographics but at the same time forget about others. Developing ideas and solutions for different people take the risk of relying on biases and preferences or on only partial target analysis and empathisation.

This process can start with a renegotiation of the terms ‘assistive’ and ‘mainstream’ both for designers as they approach a method that wants more cohesive and inclusive results as well as for the awareness of the end-users themselves. It's been considered, in this perspective, “assistive” as any tool that can increase, maintain, or improve the functional abilities of people with disabilities (Mangiatordi, 2017) and any technology that enables someone to accomplish something they could not normally do (Lischetti, 2007). On the other hand, “mainstream” would be that shift from a design approach that focused specifically on separating elements and “special needs” to a more cohesive inclusive design approach, incited by people themselves (Fleck, 2019). In this sense, the goal of bringing technologies and design solutions born to compensate for specific needs within

a broader pool of users, leads to working from the particular to the general in order to normalize and make more widespread solutions that can benefit not only the minority for whom they were designed.

In this sense, the purpose from the design point of view should be precisely to bring together abilities of different users, finding in those specific solutions a way in which they are integrated into the concept of normality on a broader level. And, on the other hand, to embed this vision and objective already in the process of design, rejecting approaches that associate a deficit or a very specific requirement with a consequent exclusion.

Indeed, “design is much more likely to be the source of exclusion than inclusion” (Gilbert, 2019) even if the design process may, in many cases, create artifacts perfect for a specific demographics but at the same time forget about others, or focus their solutions on specific groups by devising rather separate and divisive designs.

Physical and digital spaces as an extension of the possibilities of inclusion

Foremost, to identify a common advantage, it must be taken into account that this actually lies between shared benefit and standardization, just as part of that process that makes projects scalable from the specific to the general Fig. 1. This consequently requires an intersection of practices which pertain to the physical as well as the digital world, tending towards continuity and not separation, seeking integrated and integrable ways of interaction Fig. 2.

The pandemic period has made it clear that technology itself may be a discriminating factor, not just a means of integration and inclusion. In this regard, it seems appropriate to ask what inclusion really means in an era that is pervaded by technology: which ones are the fields of action and ‘reality’ and consequently the tools.

The pandemic period has made it clear that technology itself is a discriminating factor for including people in the workflow of study, work, and leisure: architectural barriers and digital spaces designed for users with specific abilities and knowledge can be equally exclusionary elements for certain categories, without taking the others into account. “Physical space can cause difficulties as the world of web platforms if they are not optimized for the needs of different users” (Morozzo et al., 2021, p.19), so much so that it is essential to consider the continuity of interactions between physical and digital, analogue and connected environments. Otherwise, not considering multiple ways of interaction at the beginning of the design process, will not only exclude users with different physical abilities or technological knowledge but will also make projects less scalable. Considering multi-sensory solutions allows to address various needs and overcome limitations.

When it comes to inclusion therefore, it is not possible to divide between digital and analogue, in-presence, and virtual experiences, because the moment one is in a space is mostly the possibility of interacting elsewhere at the same time. This can be a strength in the moment it is able to multiply the possibilities of access to a project,

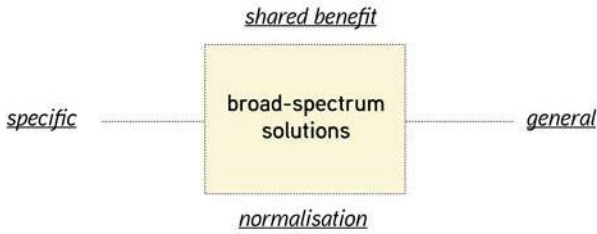


Fig. 1

Fig. 1
 Indicating the requirements and terms for broad-spectrum solutions, scheme credits: Federica Delprino.

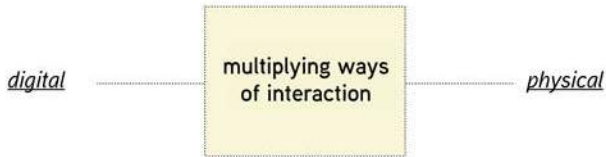


Fig. 2

Fig. 2
 Inclusive intersection of accessibility possibilities between physical and digital, scheme credits: Federica Delprino.

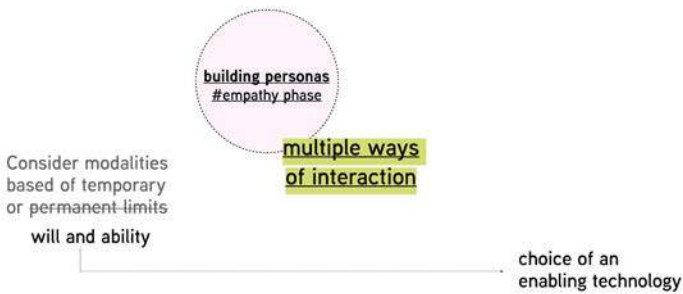


Fig. 3

Fig. 3
 Process proposal scheme for building inclusive personas based on the multiple modes of interaction and subsequent choice of enabling technology, scheme credits: Federica Delprino.

to a location, and having an experience of it. It thus turns out to be necessary to design inclusive 'phygital' interactions, in which is meant interconnection between the physical and digital layers that enhance the meaning and value of the original object (Lo Turco & Giovannini, 2020), in which the real and digital worlds more than overlap exist in the continuity of identity and interaction.

Multiple ways of interaction through “personas”: what we need to consider to design inclusively

The possibility to offer different interaction modalities to the potential user, visitor or inhabitant allows the latter to choose how to relate to the device, the object, or the experience, according to his or her perennial (e.g., permanent disability) or momentary (e.g., transitory deficit, preference, need of the moment) needs. This also makes a project scalable, durable, and more resistant to adversity as it is accessible in many ways. It also makes the use of a space or an object a real experience, which can be varied at will. It's a competence of each designer to impose what is 'usable' and 'normal' in the context in which they move since the latter is the one who decides how his design - whether it be an object, a building, an interface, or a service - is used. This is simply defined: by majorities; by the technology and the modes of interaction adopted; by the selection of the context and the construction of the personas for which one decides to design.

The personas approach intends to involve the designer in the daily lives of potential users, submerging them with a kind of 'projection foil', so as to identify behavioural patterns and possible future actions (Gaiser et al., 2006). It is as crucial as it is complex to have a standpoint on personas that is free of stereotypes and that can really bring out the necessities to be addressed in the project. On a professional as well as an individual level, it is vital to develop skills related to specific resources in order to stimulate empathy and to be able to cross-fertilise needs for project purposes. An empathic cognitive style towards personas could mitigate an egocentric approach and help to understand users through personas (Marsden et al., 2017). The qualitative approach, while within a model for a shared tool that can still be adapted as needed, is important because a massive data analysis can indicate trends in specific actions, not actual behaviour (Brewer et al., 2017) and especially the underlying motivations, intentions, and exigencies.

Still keep in consideration, on the other hand, that the very way one does research and includes any information may vitiate the point of view regarding personas and stereotype them, disregarding what they may have in common. For instance, creating different targets does not necessarily mean producing distinct solutions; on the contrary, it is possible to intersect them in such a way as to find sustainable meeting points. One of these, for example, is precisely the ability and capacity to interact in a context.

There is the opportunity of considering the most appropriate modes of interaction as we build our personas from the users' abilities.

It may be added to the perspective of “Persona Spectrum” held in “Inclusive: A Microsoft Design Toolkit” (Holmes, 2018), which reminds the designers how certain solutions can fit broad and complex situations and the needs of various individuals. Indeed, it “aims to understand related maladjustments and motivations through a range of permanent, temporary and situational scenarios”. If one adds to this principle the conspicuousness of different modes of interaction and put the capabilities together, the design trend may naturally tend towards inclusivity.

Starting from the concept of including different ways of interaction as a means of generating not only basal accessibility and thus a purely practical and basic compensation of enablement, but also togetherness and a certain level of engagement, it is essential to work on the users from the outset, thus identifying the personas with these premises. Hence, one speaks of a design action that from the very first phase of empathisation, even before the identification of the solution, bases the design line on the possibilities of interaction of the users with their surroundings as well as their will and inclinations, in order to fulfil a series of needs but also to achieve involvement purposes. It will therefore tend to consider not only modalities based on temporary or permanent limits, but also will and ability [Fig. 03]. This will consequently lead to the choice of enabling technology, or at any rate a set of solutions based on inclusion and accessibility requirements that are tailored to people’s capabilities rather than halting at those limits that tend to separate them.

Touchless solutions: voice interfaces and gestures at the service of inclusion

Expanding interaction modalities gives the opportunity to include and entertain at the same time, making the same concept usable and durable in various circumstances.

Thanks also to the period of health emergencies, in recent years there has been a clear need to explore antifragile solutions (Taleb, 2014), capable of adapting to difficulties by foreseeing them at the design stage. It’s an approach also tending towards a “blue economy”, with the will to pool resources alongside people, highlighting a thousand today for a hundred problems. If we address this by uniting people, we move towards a system capable of so-called autopoiesis, i.e. the ability to regulate itself, to adapt to interruptions, disturbances and shocks, and to thrive within such distinct boundaries (Pauli, 2017).

When trying to limit a virus that is also transmitted through surfaces, all non-touch solutions are effective: voice assistants, interfaces managed through sound, motion sensors, etc., which have the characteristics to include and bring together categories of users that were previously often separated by different needs. The latter, however, thanks to these multimodal solutions can meet in (physical and/or) digital spaces designed to unite and relate them - in the broadest sense of the term. The use of touchless technologies can be found in medical contexts, within many private homes but also in exhibitions

and museums. They are an effective means of enabling a user to use a service or space, as well as entertaining and engaging solutions for a wide audience.

Touchless is an example of a mode of interaction that is not purely visual-based that can increase interactions and access possibilities, towards a common benefit. Touchless gestures may seem relegated to the imaginary connect with dystopian entertainment pieces and tv shows such as 'Black Mirror', which nevertheless shows some application examples that can be used in the Graphical User Interface (GUI) and that can be included in the Natural User Interface (NUI), an intuitive interface that eliminates the need for physical and mechanical devices such as mice, keyboards,... and have the advantage of being intuitive, such that the user does not need to learn specifically how to work with it (Chuta, 2019). Similarly, one has to consider a verbal interaction of Voice User Interfaces (VUI) that can be provided by Voice-first devices or Voice-enabled devices (Van der Linden, 2019), which have different inputs and outputs and again require different mental and bodily engagement.

Although the technology for touchless gesture input has been investigated, there is room to investigate meaningful, practical and intuitive implementations for touchless gestures; what needs to be explored pertains to feedback (Olofsson, Söderberg, 2013). It is true that a strength may be precisely the lack of pre-requisites and thus make way for an easier inclusion; on the other hand, it is relevant to strive for accurate and meaningful gesture recognition and to identify vocabularies of natural, intuitive, and meaningful gestures suitable for the tasks at stake" (Sukeshini, 2011).

The contribution in this instance seeks to place an emphasis rather than on the technologies themselves that include touchlessness, more on the opportunity that may create to foresee in the design solutions the possibility of interaction based on different senses and abilities, with the possibility of actually making a choice of relation with the surrounding space and artefacts.

From this point of view, touchless, in the wake of widening solutions and changing habits in the post-pandemic era, may be among the interaction solutions that deserve a focus on their inclusive potential. Even more so if the talk about hands-free and voice interaction is directly related to user profiling from its inception and not inserted as a fallback possibility or without a specific reason.

Conclusions

Expanding the modes of interaction and considering 'inclusive skills' from the design 'empathize' phase can result in more inclusive projects. This may ensure a role for all actors in a system, making it more sustainable in both social and economic ways.

This is fundamental to unite minority groups to mainstream solutions to embrace normalization: not to produce just specific products and thus create separation, but also unnecessary and unsustainable in both environmentally and socially ways. This is also

crucial to generate systems that can withstand periods of crisis. A clear example is *touchless*, a modality of interaction that includes many users in previously exclusive experiences and so has become central in solving problems related to touching potentially infected surfaces. This is not a definitive, all-encompassing solution, but a clear indication of the importance for an inclusive perspective of broadening the modes of interaction from the very beginning of the design process, and an example of how a solution that was in many cases niche has become truly useful at the moment of a paradigm shift, which has made its feasibility clear.

It is therefore essential to look from the *particular* to the *broader* right from the design phase, ensuring a role for all actors in a system, who can then support and embrace it.

Alongside, it's very important and not implied to carry out this step with a focus on design tools, so as to provide ways to work on user needs and target segments not in a stereotypical way that necessarily induces different outcomes. Bearing in account the opportunities for inclusiveness offered not only by technology but by the concept of interaction with space itself in various vocal and gestural manners, the personas tool can be proposed and reconstructed in a different guise and implemented according to abilities and ways of interaction.

These premises were, for instance, declined within the experimentation of a version of the personas tool called 'Inclusive Multimodal Personas' (Delprino, 2023), which provides a checklist and parameters for generating dynamic and inclusive user profiles and verifying the systemic accessibility of projects, within different phases of experimental workshops. The contribution thus proposes a path from empathy to inclusive design, placing knowledge of common and fluid user needs side by side with multisensory solutions, so that these may be sustainable from a social point of view but also from an economic and technological perspective. The framework results as the foundation of a mindset and approach that, as future steps both already ongoing and to be developed, see the implementation of design tools in a variety of areas, project types and in the education field.

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Ethnography in Sever Do Vouga: Reality<>Change First Step to Engage a Creative and Rural Community

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Abstract

This article reflects the ethnographic work carried out in Sever do Vouga, during the year 2022, within the scope of ongoing doctoral research. This step is the first phase of a set of six that make up the “Reality <> Change” methodology - an adaptation of the “Double Diamond” model developed by the Design Council (2019) made by researchers from ID+ and DESIS - which aims to study the impact of Creative Industries in combating population decline in rural environments. Sever do Vouga is the place chosen to develop this investigation, as a result of the author’s contact with this territory since 2013. It is also the objective of this investigation to prove and verify this methodology.

Keywords

Design
Co-Design
Social Innovation
Rurality
Creativity

Introduction

Introduction to the Problem

The population desertification of the Portuguese interior is a gradually alarming reality. Since 2013, the research work carried out by the “Maneiras de Sever” (Mds) project in Sever do Vouga, within the scope of a Master in Design (Fragoso Lopes, 2013), has shown that this county has been one of the most affected by this phenomenon in Portugal.

According to PORDATA (accessed on 27/11/2020) and CENSUS (accessed on 27/07/2021), Sever do Vouga’s population has steadily declined since 1991. The county has experienced a significant population loss of 10.42% between 2011 and 2021, surpassing the 6.29% decline observed between 2001 and 2011. This decline approaches the demographic values recorded in the 1920s and 1930s.

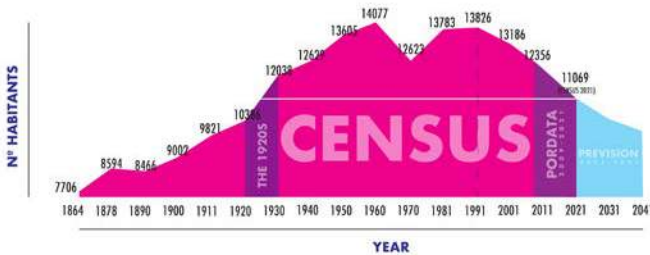


Fig. 1
Demographic evolution of Sever do Vouga. Credits: Pedro Fragoso Lopes.

The ethnographic research and demographic analysis revealed a slight reduction in population decline among younger age groups. Some students who participated in the first Mds event not only return after higher education or professional training but also encourage others within their social circles to return (Fragoso Lopes, 2021). This movement has led to the emergence of jobs, cultural initiatives, and creative projects primarily driven by young people aged 20 to 24. These developments may explain the mitigated decrease in the young population within this aging and rural territory, as supported by recent data (PORTDATA).

Rurality and Community-driven Creative Solutions

The rise of European programs addressing social issues through creative solutions highlights the importance of connecting community, creativity, and public policies. UNESCO has actively promoted the development of a network of Creative Cities since 2004, prioritising creativity and cultural industries in local development (UNESCO, 2018). In Europe, initiatives like the “New European Bauhaus” project also emphasise this issue: the case of Tenk Træna, showcased by Moa Bjørnson during the “Nordic Co-Design: New European Bauhaus” event in 2021, which falls under the thematic agenda of “Digital Innovation and Smart Communities”. Through initiatives like the AIR Træna project (AIR TRÆNA, n.d.), designers,

artists, entrepreneurs, and creatives are drawn to the area, diversifying employment opportunities and fostering local economic growth of this village located in the remote Arctic Circle region of Norway that relies on the fishing industry. Successful projects demonstrate the significance of community involvement in developing tailored public policies, facilitating dialogue between decision-makers and the population, and leveraging participatory design and social innovation methodologies for regional development. The “Alto do Vale do Itajai” project and the “Creative Citizens” initiative in Milan, referenced by the Desis Network (2019), exemplify effective community engagement.

In Portugal, funding programs such as PRODER and FEDER reflect an ongoing commitment to addressing challenges faced by sparsely populated areas. The second edition of the Aldeia da Inovação Social initiative, supported by European funds, focused on tackling issues within the country’s interior regions, took place in a village severely affected by population decline due to desertification, and it involved a call for proposals aimed at combating population desertification in these interior regions (Aldeia da Inovação Social, 2023).

Regarding Sever do Vouga, the previous experience gained from the MdS project, which was characterised as an artistic and cultural endeavour, directly impacted the youth in this area. It helped address the existing gap in creating individual job opportunities within the creative and cultural sectors, contrasting with the limited options in the traditional industrial (32.6%) and service (26.8%) sectors.

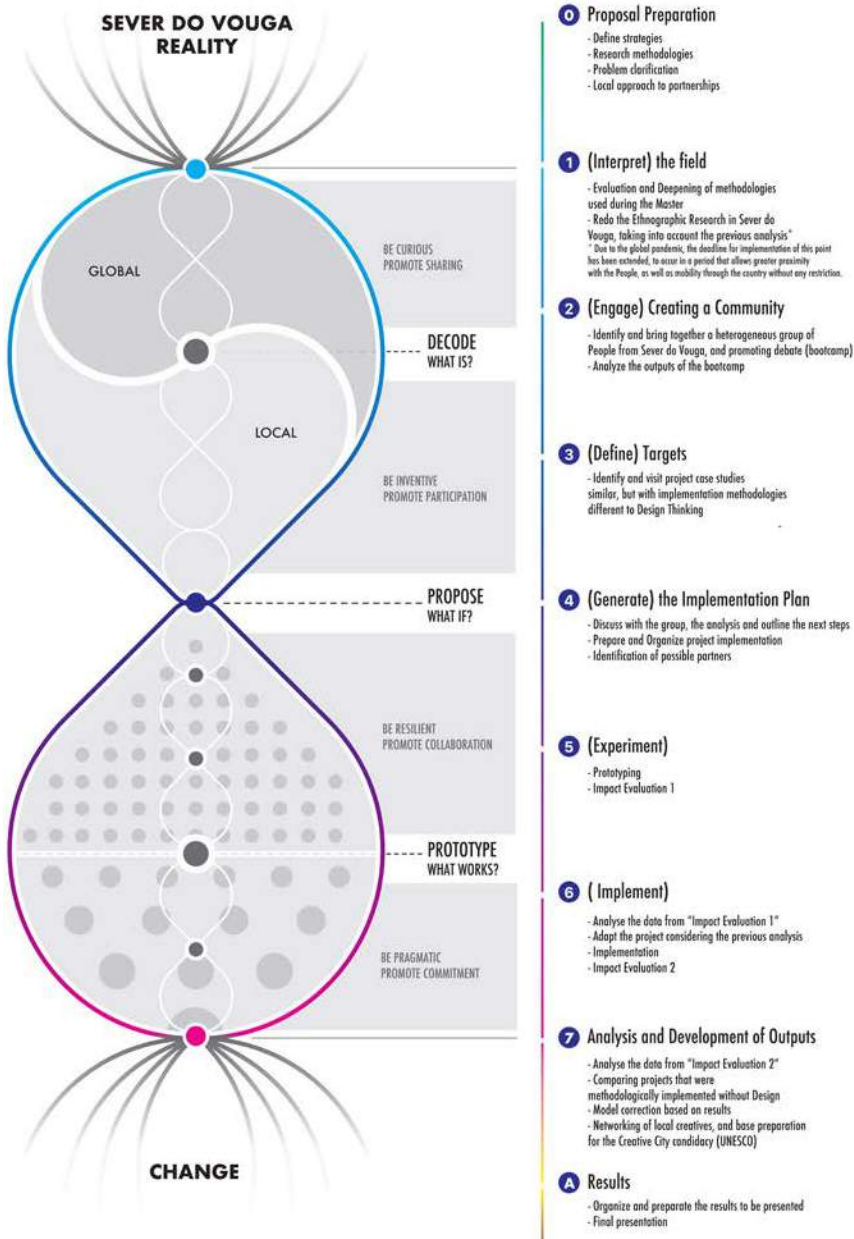
This reality underlines the potential of promoting these sectors in Sever do Vouga, along with strengthening Design for Social Innovation methodologies offered by the MdS project. Such efforts could stabilise the region’s demographics while perpetuating and reinventing the local culture. Evaluating the long-term impact of combating desertification requires a strengthened community engagement approach. Thus, Sever do Vouga presents an ideal space for “promoting, supporting, strengthening, and replicating” initiatives, as proposed by Manzini (2014).

“Reality<>Change” Methodology

The aforementioned context provides a unique opportunity to advance research by validating and leveraging the identified dynamics. Inspired by Simon’s (1968) seven-phase model - define, research, ideate, prototype, choose, implement, and learn - this investigation adopts a participatory approach and methodology. Noteworthy discussions regarding this model have occurred among Cross (2011), Brown (2009), and Baeck & Gremett (2011). Moreover, IDEO’s Design Thinking framework ([designthinking.ideo](https://www.designthinking.ideo.com/), accessed on 03/2021) has contributed to its widespread recognition.

Building upon this foundation and utilising established Design Thinking tools, this research aims to develop new co-created tools with the Sever do Vouga community. It also draws upon the “Reality <> Change” model, a customised adaptation of the “Double Diamond” model by researchers from the ID+ and DESIS networks. The “Reality <> Change” model proposes six phases to drive positive change in the studied context. This article focuses on Phase 1, which involves interpreting the territory through ethnographic research. It also explores the

underlying assumptions of Phase 2, aiming to capture the essence of community-building in this case. The investigation suggests adding a preparation phase (Phase 0) and a comprehensive analysis phase (Phase 7) to enhance the model's effectiveness.



Therefore, this context not only provides an opportunity to validate the research model but also aligns with the author's assertion that "the consolidation of the methodology and the experimentation of new ones" are vital for future progress (Franqueira, et al., 2019).

Fig. 2 Graphic visualisation of the timeline for this investigation adapted to the "Reality<->Change" methodology. Credits: Pedro Fragoso Lopes.

Ethnographic Research

Although based on statistical information, the identification and characterisation of the problem reported in the first point of this article focus on informal reports, as a result of the long-standing relationship between the researcher and the territory, making it clear today that this has been a continuous practice that tends to stabilise as structured ethnographic research. Ethnography, as a form of observation within the natural circumstances of social reality, is characterised by learning through everyday experiences in the community. It aims to understand their culture, thoughts, and modes of action, providing analysis and justification specific to each unique ethnographic study.

According to Hannula, Suoranta, and Vaden (2005), three aspects define the study environment: 1) "Material Environment" - the location, its topography, accesses, and nature, among others; 2) "Human Environment" - the resident people, how they act, what they do and how they speak, and, finally; 3) "Learning Environment" - how people interact with each other, between authorities or external agents.

For this particular case, the focus is on studying the "Human Environment" and the "Learning Environment," as the "Material Environment" has already been extensively explored and verified by the author (Fragoso Lopes, 2013). The work conducted in the territory since 2012, as part of the MdS project, has fostered a close relationship between the researcher and the local population over ten years. This enables the researcher to adopt an ethnographic approach, benefiting from the advantages of an insider (personal relationships with Sever do Vouga inhabitants) and an outsider (being an external element with some influence on municipal bodies).

Maneiras de Sever 2022

Over the past ten years, the five editions of the MdS project have made it possible to listen to the societal and demographic fluctuations of this county, and now allow the identification of some tangible results, despite the population decrease, in general, has been accentuated during these same years. The continuous nature of the project and its repetition over five editions have led to adaptations in the approach towards participants, with the last edition, which took place during the 2021-2022 academic year, providing relevant information for this investigation.

Brief historical summary of Maneiras de Sever

The initial design of the MdS project in 2013 targeted 9th, 10th, and 11th-grade students, intending to conduct extracurricular workshops in photography, video, and audio. However, the project was implemented that year with only two classes of the art course. Six themes were also defined to work on, which served as guidelines for the organisation of the project in the following editions (Fragoso Lopes, P. 2013): Natural patrimony, Historical Heritage, Economic Activities, Culture, Sports, and "Severenses" - People from Sever do Vouga.

Thirty students from the Agrupamento de Escolas de Sever do Vouga (AESV) participated in the project, approaching the county artistically through photography, sound, and video, thus allowing the definition of the operating model within the classroom as a functional method, and not extracurricular as initially proposed. The first MdS exhibition took place in 2013 at the Centro das Artes e do Espectáculo de Sever do Vouga (CAESV), featuring various works and musical performances.

The second edition of MdS occurred in 2016, with increased support from AESV, which approved the integration of the MdS into the curriculum of the courses. This adaptation allowed the participation of other school years, such as the Elementary School, and the expansion of the proposed activities, such as the introduction of drawing and 3D models, among other artistic interpretations. This edition involved 400 students, and the MdS exhibition was held at the Municipal Museum.

In the third edition in 2018, additional work models were introduced, including musical, scenic, and poetic interpretations, involving more than 650 students and 20 teachers. The project gained national and international visibility through presentations at events such as the 1st Vital Regions (Viana do Castelo), the 5th Edition of the Good Practices Exhibition organised by GRACE (Porto), and the XV International Congress of Educating Cities (Cascais).

The fourth edition received support from the Calouste Gulbenkian Foundation, within the scope of the project "Academias Gulbenkian Knowledge", which allowed for the intervention of around 1250 students from AESV. In 2020, due to the COVID-19 pandemic, the exhibition shifted to an online platform, showcasing works from not only that edition but also the entire collection from previous years, thus fulfilling the desire projected in the development of the first edition of aggregating all work on a single digital platform.



Fig. 3
"Antigamente, era assim em Sever do Vouga". 2nd-grade students, dressed up as their ancestors, ready to interpret the old way of living in Sever do Vouga. Maneiras de Sever. Credits: Pedro Fragoso Lopes.

The fifth edition took place in the 2021/2022 academic year and provided an opportunity to reflect on the project's journey and adapt methodologies to conduct a closer investigation of the young community, with the results potentially integrating the current investigation.

Doing ethnography during the 5th edition of Maneiras de Sever

Driven by the aspiration to infuse innovation into this project, the 5th edition of the event placed a significant emphasis on Street Art. Building upon a previous project in 2018 that resulted in the creation of the first mural in Sever do Vouga, dedicated to the lamprey species, this edition featured the production of five Street Art murals by 9th-grade students from AESV. During the event, which spanned from April 29, 2022, to May 29, 2022, five Street Art murals were produced by 9th-grade students from the AESV, with the support of the teaching community and under the expert guidance of Rafi die Erste, an internationally renowned Street Artist known for nurturing projects from their inception. The event encompassed various artistic works, including modelling, music, theatre, and dance, and involved the participation of eight local artists through an Open Call organised by MdS. Supplementary activities were organised in all parishes of the county to ensure broad community involvement.

Unlike previous editions that extensively explored well-known local landmarks, this edition aimed to instil a more critical perspective among students regarding their territory. They were encouraged to analyse Sever do Vouga through three lenses:

- 1 What aspects of Sever do Vouga do you appreciate the most?
- 2 What existing elements in Sever do Vouga could be improved?
- 3 What does Sever do Vouga lack that would be beneficial if it existed?

This challenge demanded additional effort from approximately 630 participating students, as the project's simplicity was intentionally reduced. The outcomes included proposals for nonexistent services and infrastructures that could potentially occupy vacant spaces or buildings in Sever do Vouga, manifested through three-dimensional models, clothing items, and other artistic expressions, besides the five Street Art walls aforementioned. These creative endeavours demonstrated the students' critical thinking skills and civic engagement. The public response to the exhibition and cultural events was noteworthy, underlining the community's interest in the project.

Tailored to the youth of Sever do Vouga, this new approach represents an evolution of the methodology introduced in 2013. It stems from the interventions made during previous editions, which provided the AESV community with a platform to express their views on their connection to the county and how it could be enhanced by addressing their identified needs. By offering an unconventional means of artistic expression and fostering co-creation among peers and teachers, this approach empowered young individuals to articulate their opinions, nurture critical thinking, and exhibit civic consciousness. As for the proposed initiatives, their execution now rests with the deliberation of the political authorities within their term.

While the 5th edition of MdS was underway, an investigation was conducted into the local songbook to explore the cultural roots of the community and seek a reinterpretation in collaboration with two local musicians. The outcome of this research and collaboration would be presented as a multimedia performance concluding the MdS fifth edition.

The investigation started with the songbook created by Carlos Marques, a musician, and conductor of Banda União Musical Pessegueirense in Pessegueiro do Vouga, Sever do Vouga. Co-produced with his mother, the songbook featured nostalgic tunes and songs from the past and served as the basis for a concert titled “Do Sacro ao Profano” held in 2019 at CAESV - a concert aimed to revive these traditional themes and incorporated theatrical performances on stage to recreate sung traditions. Alongside the songbook, research was conducted on old videos filmed in Sever do Vouga during the second half of the 20th century. These included the film “A luz vem do alto” from 1958, which was shot in Sever do Vouga, excerpts from Michel Giacometti’s documentary “Povo que canta” (1961-1974) featuring Female Polyphony in Rocas do Vouga (Sever do Vouga), and home videos available on digital platforms showcasing life in the riverside area of the county and the “Vouguinha” steam train crossing the Vouga valley.

The Poetry Group of CAESV was also involved in the project and was approached with a proposal to recite local legends as a prelude to the planned concert. Rather than reciting individual legends, the group decided to prepare a continuous text that connected various existing legends, highlighting their similarities and differences across different places of worship or variations in storytelling.

With the group formed and the material defined, rehearsals for the performance, later named “A Canção vem do Alto” about the aforementioned film, began. Alongside the legends session, seven songs were arranged and presented with video projections, combining traditional singing styles with contemporary musical movements. This fusion allowed for the integration of Feminine Polyphony with Post Rock, instrumental and ambient elements, and even instances where the melody was interpreted solely as poetry.



Fig. 4
“A Canção vem do Alto”.
Photography of the “A
Canção vem do Alto”
concert held in CAESV, in
May 2022. Maneiras de
Sever. Credits: Gonçalo
Carvalho.

Those involved in the process described it as more than just a concert or performance but as a means of celebrating and honouring their territory by creating something unique, which could potentially be replicated in other public performance contexts.

Interviews

The close and continuous engagement with the youth of the county, along with the strong connections to local companies and the community, played a crucial role in the selection process for this investigation (Coutinho, 2013). The study focused on individuals who had a connection with the creative and cultural sectors and a residential link to Sever do Vouga. Three personas were defined based on these criteria:

- natives of Sever do Vouga who reside there;
- individuals born in Sever do Vouga but currently living elsewhere;
- residents of Sever do Vouga who are not native to the county.

Having established the parameters for the sample, the goal was to gather insights from approximately 30 individuals, with 10 participants from each group. Semi-structured interviews were conducted to explore their experiences, connections with the county, and involvement in local creative and cultural activities. The aim was to uncover elements that would complement the desired sample.

The first interview, conducted on October 30, 2020, was with “Magalhães,” who fell into the category of individuals born in Sever do Vouga but not currently residing there. This initial interaction led to the identification of three potential participants for the study. The plan is to continue the interview process, refining the questions to explore the concept of “the ideal place to live” based on insights from “Who’s Your City?” by Richard Florida (2008). This will enable the identification of both positive and negative aspects of living in Sever do Vouga. The ultimate goal is to assemble a group of creative individuals or those closely connected to creativity, with strong ties to the county. This group will then move forward to co-design a Social Innovation project, advancing to Phase 2 of the “Reality <> Change” methodology, which involves gathering a diverse group of people for debate and collaboration.

The snowballing process has been initiated, where subsequent interviewees are suggested by previous participants, minimising the researcher’s influence in the selection process and limiting the researcher’s role in initiating the first interview.

Conclusion

The results obtained and identified in points 2.1.2 and 2.2 of this article, along with the interview identified in point 2.3, provide support for the direction of this research toward the development of a project involving the community and the creative industries. It also demonstrates that giving a voice to young locals through artistic movements promotes greater and more relevant communication between them and the local municipal authority, while at the same time making them aware of their role as citizens of Sever do Vouga.

Furthermore, the analysis of the local songbook revealed that most of the themes found are linked to farming in the field, and were sung during the work exercise, being therefore intrinsically linked to the local culture, which proves to a certain extent what Florida (2002) tells us when he contrasts with the execution of “organised and systematised” work, the need to involve creative activities, as a way of motivating and promoting innovation in these same tasks, such as the spinning of flax or the cultivation of corn, is performed with greater avidity and motivation, if accompanied by musical moments, which, in addition to maintaining the rhythm of its execution, fed the capacity of this community to develop culturally, fighting the “stupefaction and ignorance” of the same (Smith, 1776).

Given that this idea revolves around a local community and identity, it is argued that a Design for Social Innovation project is crucial for placing the user at the center of the conceptualisation process. The proposal involves establishing a working group of locals and facilitating constructive discussions to identify the positive and negative aspects of Sever do Vouga’s reality, with a particular focus on understanding the causes behind three decades of desertification.

The problems and solutions identified will be validated through case studies in similar circumstances, in national and European territories, identifying good practices of implementation and realisation, as well as the clarification of the valences of a creative community project, thus entering Phase 3 of the “Reality <> Change” methodology.

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The Implementation of U.D. in a Metal Processing Plant of the Metropolitan Zone of Guadalajara (MZG)

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Abstract

This article presents an analysis of the effects of the implementation of the principles of universal design on the level of exclusion of workstations and on the musculoskeletal symptoms and productivity of workers in a metal processing plant in the Metropolitan Zone of Guadalajara (MZG). The purpose of this study was to obtain information from a MZG metal processing plant that reflected in detail the level of exclusion and the skills required from the employees in order to propose adaptations based on the principles of universal design with the objective of increasing the level of inclusion and reducing the musculoskeletal symptoms in the neck, shoulder and spine of the population that works in the selected workstations of the plant while maintaining or even increasing the level of productivity.

Keywords

**Universal design
Accessibility
Metal Processing Plant
Elderly People
Metropolitan Zone
of Guadalajara**

This article presents an analysis of the effects of the implementation of the principles of universal design on the level of exclusion of workstations and on the musculoskeletal symptoms and productivity of workers in a metal processing plant in the Metropolitan Zone of Guadalajara (MZG). The purpose of this study was to obtain information from a MZG metal processing plant that reflected in detail the level of exclusion and the skills required from the employees in order to propose adaptations based on the principles of universal design with the objective of increasing the level of inclusion and reducing the musculoskeletal symptoms in the neck, shoulder and spine of the population that works in the selected workstations of the plant while maintaining or even increasing the level of productivity. The assessment was based on the application of the University of Cambridge's exclusion calculator (University of Cambridge, 2015) combined with an internal analysis of the metal processing plant, this provided the required employees physical and cognitive capabilities. The adaptations applied directly on the assessed workstations were based on the implementation of the universal design principles for the subsequent re-evaluation that allowed a comparison of the obtained results, thus accepting the hypothesis that establishes that the increment in inclusion decreases the musculoskeletal symptoms, maintains or even increases the productivity of the intervened workstations while increasing the hiring spectrum of the metal processing plant of the MZG.

This analysis and subsequent adaptation were carried out because there is already a problem that will continue to increase as the time passes, which is the exclusion of the elderly within the Mexican industry of metal processing as well as the existence of risk factors due to the lack of application of ergonomics to the current population of these plants, which potentiate the risk of injury in short or long term and maintain a general dissatisfaction among the working population. The exclusion of older adults within the Mexican metal processing industry as well as the existence of risk factors due to the lack of appropriate conditions in the scenarios of said plants so that they can be considered as inclusive directly affects this part of the population since 34% of older adults in Mexico continue to participate in economic activities (INEGI, 2017).

Kawakami, M., Inoue, F., Ohkubo, T., Ueno, T. (1999) pointed out that the ratio of older adults to younger people is increasing worldwide thanks to medical services and lifestyle change, which has resulted in a considerable reduction in labor productivity since elderly people remain active in the workplace for longer periods of time, this reduction in productivity is verified by studies that specify the reduction in the physical and cognitive capacities.

Gonzalez, I. and Morer, P. (2015) report in their study that an inverted pyramid of the population is predicted for the year 2050, with the number of older adults being greater than that of young people, varying in proportion from one country to another therefore requiring a profound processing of our model of society. One of the results of this field study was that even the most ergonomic designs were used inappropriately due to a lack of consistency between tools, as a result not only were older workers not enjoying an ergonomic workstation, but also users of all ages and workspaces.

Vieira, ER and Kumar, S. (2007) mention that lower back disorders are common and represent the most expensive and frequent musculoskeletal disorder in the metal industry, they also establish that it is important to implement control programs in welding and CNC since workers in these areas frequently perform tasks that involve risk factors.

Gasca, MA, Rengifo, M. and Rodríguez, E. (2007) carried out a study that shows the results of the research that aimed to evaluate the working conditions of the metal caps area of a metallurgical company given the frequency of musculoskeletal injuries and they concluded that, having obtained the values for the static and dynamic load of the activities, it is possible to know the energy consumption that the workers have while they carry out their tasks. In this study it was observed that there were notable differences in each position studied and for 70% of the workers there was an unfavorable situation of self-esteem and insecurity for work and 42% perceived an unfavorable situation. The REBA method, for example, indicated that the postures were of high risk.

Based on what has been mentioned so far, one main important part of the methodology of this study was the application of the University of Cambridge's Exclusion Calculator 1.0, which was developed by the University of Cambridge to provide specific data regarding the factors that increase the level of exclusion of a workstation, a tool that tells exactly where it is convenient and feasible to focus when redesigning a workstation to reduce exclusion from that workstation and at the same time decrease the risk factors that have negative impact on the health of the employees who work in it. The exclusion calculator 1.0 used for this research analyzed a series of tasks related to vision, hearing, cognition, dexterity, reach and movement based on the workstation that was used by the workers, said workstation was analyzed under typical and important tasks in the plant where the study was carried out. The exclusion percentage returned by the exclusion calculator 1.0 after the analysis and data input in the interface is based on the data of a survey applied in the United Kingdom, so that percentage was established as a significant index to demonstrate the increase or decrease in the exclusion of each work station by simple comparison of the percentage obtained when performing all the analyzes under specific guidelines (both genders between 18 and 68 years old) before and after the intervention proposed in this research.

The 7 Universal Design Principles (National Disability Authority, 2012) were developed in 1997 by a group of architects, product designers, engineers and environmental design researchers led by Ronald Mace at North Carolina State University. Its purpose is to serve as a guide to designers and according to the Center for Universal Design (NCSU) the principles "can be applied to evaluate existing designs, guide the design process and educate both designers and users about the characteristics of more usable products and environments". These 7 principles were applied in the redesign and adaptation of the evaluated workstations:

- 1 **EQUITABLE USE**
The design is useful and marketable to people with diverse abilities.
- 2 **FLEXIBILITY IN USE**
The design accommodates a wide range of individual preferences and abilities.
- 3 **SIMPLE AND INTUITIVE USE**
Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or education level.
- 4 **PERCEPTIBLE INFORMATION**
The design effectively communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
- 5 **TOLERANCE FOR ERROR**
The design minimizes hazards and the adverse consequences of accidental or unintended actions.
- 6 **LOW PHYSICAL EFFORT**
The design can be used efficiently and comfortably and with a minimum of fatigue.
- 7 **SPACE AND SIZE FOR APPROACH AND USE**
Appropriate size and space are provided for approach, reach, manipulation, and use regardless of the user's body size, posture, or mobility.

METHOD

STAGE 1 (FIRST EVALUATION)

The following workstations were identified and characterized in order to apply the exclusion calculator 1.0 to each one:

- Sheet metal bending machine
- Sheet metal slitting machine
- Band saw
- Punching machine
- Plasma cutting machine
- Finishing table
- Welding table
- Laser engraver

We proceeded to make video recordings of the employees working normally in each of the workstations to be later analyzed with the exclusion calculator 1.0 and a Nordic Questionnaire for Musculoskeletal Symptoms (NQMS) developed by the Nordic Council of Ministers (Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sørensen F, Andersson G, et al., 1987) was carried out with each one of the employees every two weeks on three occasions to later process the data and ensure that the symptoms were constant.

STAGE 2 (WORKSTATION INTERVENTION)

With the results obtained from the exclusion calculator, the workstations with the highest degree of exclusion were identified and we proceeded to modify specific parts or completely change the machinery used in the next workstations based in the application of universal design:

- Punching machine
- Sheet metal bending machine
- Sheet metal slitting machine
- Plasma cutting machine

STAGE 3 (SECOND EVALUATION)

After the stations were modified, video recordings were made again to be analyzed with the exclusion calculator 1.0 and the NQMS was carried out once again with each one of the employees every two weeks on three occasions. Finally, all these new data was processed, and a comparison of the results obtained before and after the implementation of the modifications in the workstations based on the principles of universal design was established with the objective of verifying a change in the data obtained from the metal processing plant of MZG.

RESULTS

Regarding the results, each workstation was intervened with the necessary universal design principle for its modification. The median of the exclusion level obtained with the University of Cambridge's exclusion calculator was 9.19% and dropped to 8.68% after the implementation of universal design in the next workstations:

PUNCHING MACHINE

To reduce the level of exclusion of the punching machine (Fig. 1), several principles of universal design were applied, such as size and space for approach and use (Fig. 2), with which all unnecessary elements were eliminated to have more space of movement for the personnel in charge of operating the tools.



Fig. 1
Punching machine before the application of Universal Design principles with a high degree of exclusion.



Fig. 2
Size and space for approach and use.

The principle of simple and intuitive use (Fig. 3) made it possible to establish an organization in the punching machine tools, classifying them by shape and size on tables made especially for this purpose.



Fig. 3
Simple and intuitive use.

By applying the principle of low physical effort, the risk that workers had when carrying the steel sheet when it moved out from the bed (Fig. 4) was eliminated by adapting extensions to the bed of the punching machine to support said sheet (Fig. 5)



Fig. 4
Worker holding the moving sheet as it is processed.



Fig. 5
Sheet supported by extensions adapted to the punching machine bed.

Finally, the principle of tolerance for error and the principle of perceptible information were implemented in two specific ways: the use of a color code (yellow/oval, pink/circle, blue/rectangle, green/square, silver/irregular shapes and gold/drawing and sheet metal forming) to facilitate the search for tools (Fig. 6) and the engraving of technical specifications on each of the tools to facilitate the identification of the correct tool for the different thicknesses of the material to be cut (Fig. 7a and Fig. 7b).



Fig. 6
Example of color code for
the shape of the punching
machine tools.



Fig. 7a
Initial state of the tool.



Fig. 7b
Final state of the tool with
the engraving of technical
specifications applied to
be identified easily.

In this way, according to the results of the exclusion calculator before and after the application of the universal design principles in the punching machine, the exclusion level of said workstation was reduced from 10.88% to 8, 2% (Fig. 8).

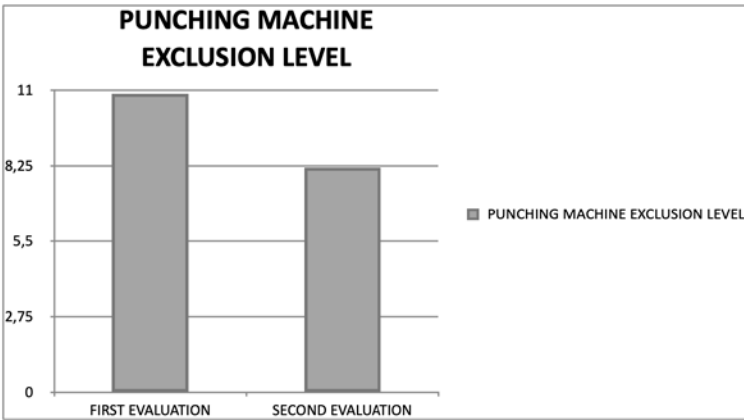


Fig. 8
Reduction of the exclusion level of the punching machine.

SHEET METAL BENDING MACHINE

To reduce the level of exclusion of the sheet metal bending machine, the principle of universal design of low physical effort was applied, in which extensions that support the weight of the sheet were adapted (Fig. 9).



Fig. 9
Supports adapted to support the sheet while it is processed.

In this way, according to the results of the exclusion calculator before and after the application of the universal design principle in the sheet metal bending machine, the exclusion level of said workstation was reduced from 9.26% to 8.9% (Fig. 10).

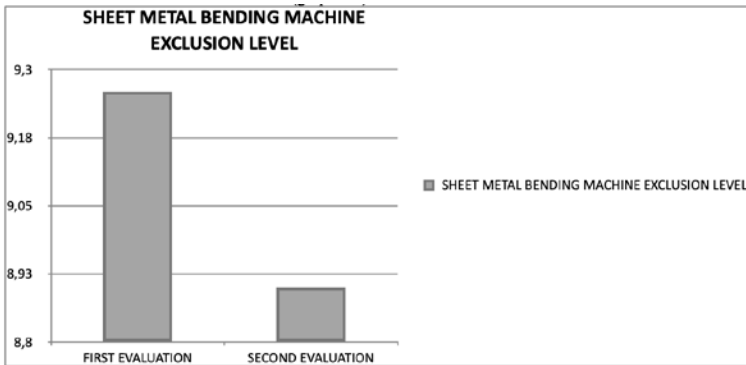


Fig. 10
Reduction of the exclusion level of the sheet metal bending machine.

SHEET METAL SLITTING MACHINE

The sheet metal slitting machine underwent a complete change based on the principles of low physical effort and simple and intuitive use, changing the previous pneumatic slitting machine (Fig. 11) for a hydraulic one with rollers on the bed to facilitate the movement of the sheets on it and an automatically controlled stop to more easily set the cutting size in millimeters (Fig. 12).



Fig. 11
Previous pneumatic slitting machine.



Fig. 12
New hydraulic slitting machine with roller and automated stop.

According to the results of the exclusion calculator before and after the application of the principles of universal design, a reduction in the level of exclusion from 9.58% to 8.3% (graph 03) was then obtained.

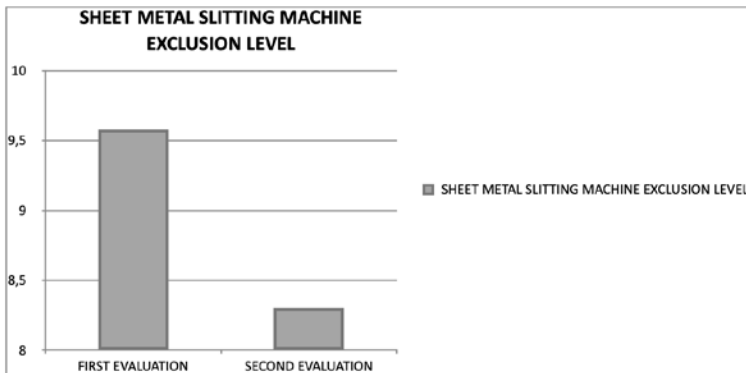


Fig. 13
Reduction of the exclusion level of the sheet metal slitting machine.

PLASMA CUTTING MACHINE

The plasma cutting machine also underwent a total change based on the principles of *low physical effort* and *simple and intuitive use*, replacing the CNC plasma that had a height of 1 meter (Fig. 14) with a CNC plasma that has a height of 60 centimeters (Fig. 15), facilitating the transfer of the steel plate by positioning it above the bed of the machine as well as the addition of an automatic height control that eliminates the need for the worker to manually lower and raise the torch while cutting the sheet that is located on the plasma bed.



Fig. 14
Previous plasma cutting machine with height of 1 meter and without torch height control.



Fig. 15
New plasma cutting machine with height of 60 cm and with height automatic control for cutting torch.

According to the results of the exclusion calculator before and after the application of the principles of universal design, a reduction in the level of exclusion from 9.72% to 8.4% (graph 04) was then obtained. It can be concluded that correct working height strongly influences worker's comfort.

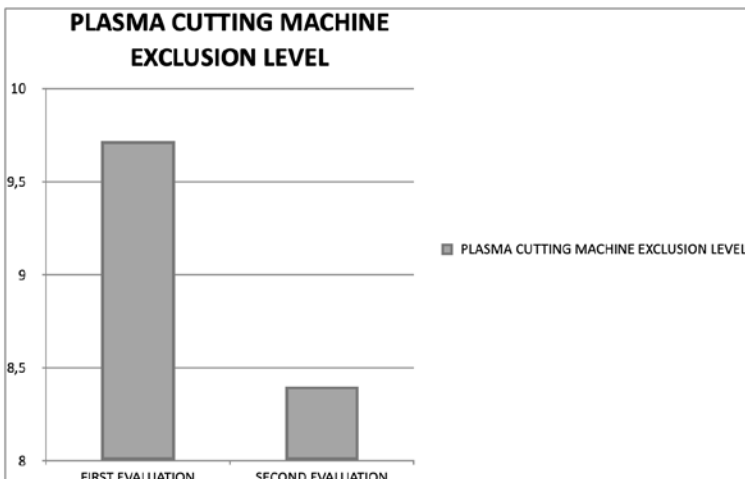


Fig. 16
Reduction of the exclusion level of the plasma cutting machine.

A specific metal component was taken as a basis to identify whether production decreased, remained the same or increased since most of its manufacturing was carried out with the workstations that were intervened, in this way the intervention directly influenced the number of parts manufactured per week which increased by 25%.

The results of a specific item of the NQMS application indicates a reduction in musculoskeletal symptoms which will have to be analyzed more thoroughly and over a much longer time interval to be able to definitively establish that musculoskeletal symptoms are reduced thanks to the implementation of the principles of universal design in a metal processing plant of the MZG. This item indicates the existence of discomfort in the last 7 days in specific parts of the body (neck, shoulder and spine) and was chosen as the basis due to the way in which the questionnaire was applied.

CONCLUSION

Taking the above into account and based on the procedure already established and the limitations of the number of personnel used as study subjects, the following is concluded:

The principles of universal design applied in a systematic and punctual manner with the aim of reducing the exclusion of specific workstations, in this case of a metal processing plant of the MZG, demonstrates to have a direct and verifiable impact in the reduction of the exclusion, the increase in productivity and the reduction of musculoskeletal symptoms, always without forgetting that in order for the reduction of said symptoms to be definitively established, a longer interval of time is needed.

The election of the times established for this study in a longitudinal manner provides the basis for continuing a deeper investigation over a longer interval of time due to the favorable results they yielded.

The proposed working hypothesis is verified in a real and physical way by obtaining statistically proven results that can be easily identified by observing how the characteristics that existed before required greater physical effort and often a greater number of plant personnel in a single workstation.

Further investigations can be made related to the work system as a whole regarding workflow, change of workstations and circulation of workers in order to avoid "one sided" body movements.

Likewise, the amount of elderly people that can be hired is favored due to the reduction of the general and specific exclusion of the plant, which increased the number of workstations that could be used by elderly people from 3 to 7 after the implementations established in the investigation.

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Towards Better Public Sector Innovation. Co-designing Solutions to Improve Inclusion and Integration

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Abstract

Migrants' access to public services is one of the most critical barriers to integration, hampered by multiple issues, including the status of migrants, which acts as an obstacle to exercising rights. To develop a more inclusive public service provision, the multiple identity dimensions and disadvantages of migrants must be considered. Co-designing in ecosystems that engage migrants, NGOs, public authorities, ICT developers, and policymakers can highly support it. However, challenges emerge from co-designing public services with and for users at the intersection of diverse axes while understanding how to adopt systemic governance that considers the various needs of the multi-level actors involved. To reason on such challenges, the article relies on the lessons learnt from easyRights, an Horizon2020 IA project, and its experimentation in four pilots. Further reflections regard the transformative impact and organisational change triggered in the ecosystem by the practice.

Keywords

Co-design

Public services

Public sector innovation

Access information

Migrants inclusion

Services as migrant's interface to inclusion and integration

As migrant flows continue to rise across Europe, migrants' inclusion and integration are pressing issues that challenge local communities and public administrations at various institutional levels, from service provision to policy making. Migrant's access to public services is unquestionably one of the most critical barriers to integration. It is hampered by multiple issues ranging from restrictive regulations related to the legal status, cultural and economic barriers, lack of information about their rights, the service provision and its procedures (Chiarenza et al., 2019; Norredam, 2011), up to limited capacity to use technology and insufficient proficiency in the host Country's language (Abood et al., 2021). This complexity is further aggravated by their immigrant status, with formal and informal obstacles to accessing services (May, 2021). Rather than being user-oriented, public services feature a multi-layered intricacy, as well as a complex service interdependence, that is a substantial obstacle to migrants' ability to access information and exercise their rights (Crockett et al., 2011). In this framework, a relevant role is played by intersectionality. It unconsciously and unintentionally affects inequality by shaping the way of thinking and, therefore, how interventions are conceived and actualised, at various levels and across all domains – from policies to regulatory and administrative systems, to the labour market, and beyond (Cho et al., 2013). Consequently, administrative processes can also play a role in sustaining discrimination and inequality, ultimately influencing people's well-being and integration, hence affecting life chances (Spade, 2013, p. 798). By extension, being at the intersection of discrimination axes creates an adverse interplay that profoundly hinders the execution of administrative procedures.

Given this premise, limited or tortuous access to fundamental services – healthcare, education, and housing, among others – and discrimination in receiving equitable services lead to social exclusion, feeding the gap between dominant and vulnerable groups (Gauthier, 2016). Governments worldwide are making an effort to take action, developing new policies and administrative rules that promote migrant's integration (OECD, 2016, 2018). At a broader scale and in a systemic way, the European Union has embraced a new phase of transformation towards inclusion and integration, building anti-discrimination policies and looking at how digital innovation can be leveraged to achieve migrant's integration (Regina & De Capitani, 2022). The situation, however, is still complex, with services acting as barriers to migrants' inclusion and integration.

Co-designing more inclusive public services

The public service provision and delivery should be inherently fair and egalitarian towards its end-users (Fisk et al., 2018; Ponce, 2005). In this regard, multiple identity dimensions and disadvantages, which are often interconnected and interdependent (McCall, 2005; Styp- ińska & Gordo, 2017), must be constantly considered when designing services (Anderson & Ostrom, 2015; Corus & Saatcioglu, 2015). The public sector has the social, cultural, and economic responsi-

bility to prioritise the development of equitable services considering the needs and the well-being of those at the intersection of multiple identity axes (Crenshaw, 1989). In such a framework, co-design can largely support the public sector in conceiving and developing solutions that better respond to users' needs (MIICT et al., 2020), considering that migrants have non-addressed needs, which are often not known/understood by those who develop such services. In doing so, also the existing disparities and mismatches between administrative procedures and real-world difficulties that migrants encounter because of their ethnocultural background (May, 2021) should be better identified and tackled. Moreover, the interaction among different actors, such as civil servants, members of the hosting communities and migrants, can provide a better understanding of each other's needs, primary aims, and effective constraints (Ruhs et al., 2019). The engagement of end-users and relevant stakeholders serves as a base to build better services, and ultimately affect and ease the multifaceted and multi-dimensional process of integration (Concilio, Costa, et al., 2022). However, co-designing more inclusive public service provision for migrants implies facing the challenge of working in a multi-axes intersectional framework while understanding how to adopt systemic governance that considers the various needs of the multi-level actors involved. Public service delivery governance occurs in a setting where users, NGOs, managers and policymakers enter the loop with specific and, most of the time, diversified visions, power differences and levels of information, and different interests.

From these premises, relevant questions arise: What are the obstacles to co-designing public services for users at the intersection of diverse axes? How is co-design challenged by taking place in ecosystems that include users, NGOs, managers and policymakers?

Methodology

The contribution relies on the lessons learnt from easyRights, an H2020 project that leverages ICT potentialities for easing migrants' ability to exercise their rights, improving their access to public services. Over three years, the experimentation involved four pilot sites – Birmingham (UK), Larissa (Greece), Malaga (Spain), Palermo (Italy) – in two development cycles. Eight solutions were co-designed and tested (easyRights, 2022a) (Fig. 1).

In each cycle, pilots identified and activated a quadruple helix community as an ecosystem with relevant actors and communities among researchers (science), tech-providers (industry), civil servants, managers and policymakers (public sector/policy), users and NGOs (society) (Schütz et al., 2019) to be engaged in co-design activities. Relevant areas and procedures needing improvement were jointly determined by the ecosystem actors. To map the access procedure, specifically seizing obstacles and barriers, migrants and other relevant stakeholders were involved in focus groups, interviews, and participant observations. This provided a clear representation of the requirements and difficulties connected to the service to target. Such findings and challenges are brought in as many hackathons where new or revised service concepts are co-designed with migrants

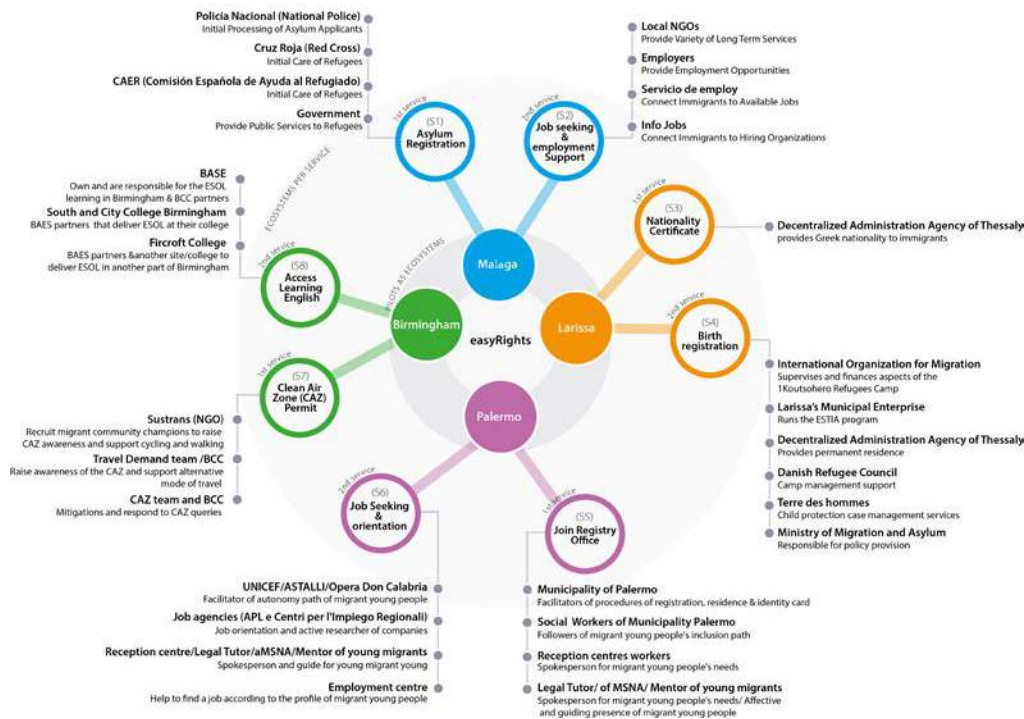


Fig. 1
Sub-ecosystems of actors
per pilot.

and other ecosystem actors (Karimi et al., 2022). The results of the experimentation are systematised and discussed against relevant literature. Ultimately, they are explored through a Triple-Loop learning perspective (Argyris & Schön, 1997; Bateson, 1972; easyRights, 2020), looking at how co-design with migrants and other stakeholders can feed transformative dynamics in the context and within the organisations and institutions involved.

Benefits and obstacles of co-designing services in intersectional ecosystems

Designing human-centric public services is a way to empower its users to access knowledge and rights in an understandable, affordable, and actionable manner (General Assembly – United Nations, 2015). Looking at services as interfaces to rights (Concilio, Costa, et al., 2022), the service provision is seen as the first obstacle to tackle to designerly start to mitigate the gaps in the integration process (Komatsu et al., 2021). In this framework, the aim is reasoning on the challenges that emerged while co-designing public services for and with users at the intersection of diverse axes.

The presence of migrants and NGOs makes the intersectionality issues barge in each ecosystem, contributing to frame the problems in the services. Relevant issues emerged from the analysis, resulting in a set of most diffused problems and circumstances that shows how the status of migrants highly affects the overall access and exercise of the services (Fig. 2).

<p>Language barrier</p>	<ul style="list-style-type: none"> cannot easily interact with officials at the front offices of services [ex. <i>"The major problem we encountered is the language issue, which affected both the communication with the hospital officer and with the Municipal officer"</i>. From the second cycle interviews in Larissa]; are unable to complete the forms as they do not understand the contents miss to understand the procedures in their entire pathway [ex. <i>"The employees at the employment centre did not speak other languages besides Italian, do not seem very motivated to put ourselves in a position to find a job and navigate the procedures"</i>. From the second cycle interviews in Palermo]; often the language provided by public administrations is not inclusive and does not correspond to the needs of the users of the service, which leads to the failure of accessing the service. [ex. <i>"a leaflet arrived through the door, wanting to learn English but didn't know where to go. My daughter read it and it encouraged me to go, so a relative took me to the local centre"</i>. From the second cycle interviews in Birmingham]; often the lack of accessible languages for migrants adds more difficulties to navigating opportunities that are provided by the government [ex. <i>"In general, all affirmed that there is not enough visibility on those job agencies and it is not really easy to find opportunities"</i>. from the second cycle interviews in Palermo];
<p>Bureaucratic complexity</p>	<ul style="list-style-type: none"> procedures are very complex and admit different pathways depending on the legal status of the migrants; the procedures are rarely presented in an understandable manner [ex. <i>"One friend told me to have gone to the registry office without knowing that it was requested to take the appointment online. When he arrived, he waited for a long time and after that, he was told to go back home because he hadn't taken the appointment. I knew about bad treatment and inequality between locals and migrants. And more, difficulties in understanding with the workers of the registry office"</i>. From the second cycle interviews in Palermo]; the strict interdependency among procedural steps make some steps of the pathways highly critical; some procedures fail to be clearly understood by all the officials who may fail in guiding the immigrants; the confusion with the big number of forms makes the service less accessible for migrants [ex. <i>At first, both me and my wife were a little bit confused as there are many steps and forms to fill in</i>. From the second cycle interviews in Larissa]; failing to understand the procedures in the entire service pathway results in losing time by doing the same thing once and again. [ex. <i>"migrants do not even know the initial steps in the process and they go back and forth between short-term employment and unemployment"</i>. From the second cycle interviews in Malaga];
<p>Discriminant behaviour</p>	<p>Officials</p> <ul style="list-style-type: none"> are not always collaborative with migrants; may show discrimination and unequal treatment towards migrants [ex. <i>"I heard about a boy who went to the registry office having an appointment agreed on the phone and not printed. He was not allowed to enter while an Italian lady, with the appointment agreed on the phone, was allowed to get in. That was clearly a discrimination"</i>. From the first cycle interviews in Palermo]; may cause unjust decisions related to immigrants' requests; often the behaviour of officials increases frustration and confusion among the migrant community [ex. <i>"we are unable to write a CV or apply correctly for vacancies online, as well as face a job interview which makes us frustrated."</i> From the second cycle interviews in Palermo].

These problems and unmet needs are the basis to develop better services. Nevertheless problems are clearly identified, the high complexity of intersectionality made pilots strive to translate inputs, needs, and insights into tangible outcomes. For instance, the Larissa pilot addressed the issue of birth registration (S4), answering the need of women in the hospital after giving birth, which according to the Country of origin, may not be allowed to interact with third parties external to the family. These women are provided with a digital solution that allows them to register the birth directly from the hospital and autonomously, rather than going through a procedure with many steps in different offices, which can take several months and involve several officials. The solution saves time for migrants and shortens the procedure to one, user-friendly, comfortable step.

Fig. 2
The most diffused problems mapped from the pilot's diaries (easyRights, 2022b, pp. 19–20)

However, beyond putting intersectionality in the loop and impacting the services at their core, the activity also makes surface how it brings specific challenges into the co-design activities, present in each ecosystem to various extent:

- 1 Limited language proficiency, often situations of illiteracy
- 2 Needs and criticalities depending on ethnocultural background
- 3 Various levels of service/technological experience and literacy
- 4 Low self-esteem of their contribution
- 5 Loss of faith in the system due to several failures
- 6 Need to avoid further frustration and failures.

While recognizing the crucial value of migrants in co-design activities, the above conditions challenge the process constituting a significant barrier to participation. Still, all the migrants involved showed enormous motivation and will to support the project in reaching its scope.

Parallel to the challenges related to migrants are those from the complex ecosystems of actors and stakeholders involved (see Fig. 1). Beyond avoiding jargon and technical terminology, the presence of users with limited language proficiency requires adopting a simple and clear language. Specific training is propaedeutic to trigger and support the various co-design phases. At the same time, the role of intercultural mediators remains pivotal in engaging migrants and empowering them to contribute effectively. Fundamental is then designing and running engagement activities to favour meaningful participation without exacerbating migrants' existing frustrations. Co-design activities, from mapping the service experience to testing early solutions necessitate careful planning and execution, being conscious of linguistic, cultural, and technological barriers that may aggravate feelings of inadequacy and incompetency.

Looking at the broader ecosystem, the public nature of the services developed requires considering and managing bottlenecks due to bureaucratic procedures, technological issues such as interoperability and compatibility, and delays due to the outsourced development of the solution to external ICT providers engaged through hackathons. Ultimately, the nature of the ecosystem also implies power dynamics, different objectives, powers, and agendas to balance.

Discussing needs, implications, and hindering conditions

The constant engagement of migrants played a crucial role in shedding light on how the status of being migrant impacts their access to services and the possibility to exercise their rights. Especially bringing multi-level actors to synergise and work together allowed to frame the problems in the current service provision across different domains, from fundamental requirements to increase information access and usability to the need to make procedures more flexible and adaptable to migrants' needs, levels of experience, legal and digital literacy. These elements add layers of complication to the framework in which co-design takes place, leading to challenge its very practice.

The discourse so far described unfolds through the process of Triple-Loop Learning (Argyris & Schön, 1997; Bateson, 1972) at the core of the project (easyRights, 2020), implying to reflect on the three dimensions of the actions for easing migrants' access to services (what), the methodological approach for achieving more accessible services exploiting ICT (how), and the value creation that underpins a systemic change in a transition perspective (why) (Concilio et al., 2021). Key reflections include the first steps of organisational change (Deserti & Rizzo, 2014; Junginger et al., 2009) triggered in pilot ecosystems. The public administrations realised the benefits from the approach and the general lack of institutional readiness towards experimentation with emerging technologies and the integration of participatory practices. The overall activity proved how co-creating with end-users and relevant stakeholders is a fundamental asset to creating better public services, showing the need to embed design in the organisational culture (Deserti & Rizzo, 2019). Consequently, the interplay among the quadruple-helix actors exposed the public administrations to reasonings orienting transformation and strategic planning for improving service provisions.

Further reasoning concerns the feasibility and appropriateness of a one-size-fits-all approach to solutions, while the logic of replication, transferability, and scaling (up and out) must be taken into strong consideration (Moore et al., 2015). Benefits to boost public sector innovation derive from sharing solutions and responsible practices among administrations or even from developing solutions in a joint effort. It is the example of the Wiki solution that Palermo later adopted and adapted by Malaga (Concilio, Karimi, et al., 2022). The Palermo pilot developed a Wiki space that puts together official and unofficial knowledge to help migrants in seeking a job, but is also a place to share their stories and help others in the same condition to understand what to do, how, and when (S6). In particular, the Wiki space supports migrants in understanding that abilities and skills they do not consider relevant are competencies to be enhanced when looking for a job. The solution was scaled out to Malaga being adapted to the context and its procedures (S2).

Conclusions, limits and open questions

Stocktaking co-design allows framing broader issues of service co-design for social integration. Although the interplay among multi-level actors profoundly challenges the co-design practices, their participation brings specific needs and perspectives into the innovation loop, clearly feeding the value production chain (Prahalad & Ramaswamy, 2004). However, multilateral improvements are required to address the real obstacles preventing migrants' integration, integrating bottom-up (co-creation and co-design) and top-down actions.

The public sector mostly operates within established structures and bureaucratic processes, which may resist bottom-up innovation. How can the existing institutional frameworks be transformed to facilitate the incorporation of innovative ideas and practices? The implementation of inclusive public service provision requires adequate resources, including funding, skilled personnel, and technological infrastructure. How can these resources be mobilised to

support the co-design and delivery of public services that address the needs of migrants effectively? Considering the conditions of the setting, what are the most responsible strategies, scalable beyond the pilot dimension, for a steady engagement of migrants, NGOs, public authorities, ICT developers, and policymakers in co-designing inclusive public services? A bottom-up approach to public sector innovation requires strong political will and leadership support. To what extent can policymakers and public authorities embrace and sustain such approaches, considering potential resistance and the need for long-term commitment?

To guarantee the existence of a social landscape of sustainable integration, commitment to embed diversity should extend from inclusion policies to effective engagement of end-users in co-creation, ensuring equitable and more suitable conditions for conceiving and developing better solutions that are user- and migrant-friendly. To bring such a transformative impact requires a systemic organisational change that sets more favourable conditions for a steady and seamless end-to-end collaboration between public administration, industries, and civil society, as the parties involved in migrant integration in society. According to this, the impact of participatory practices is also on the level of organisational learning (Deserti & Rizzo, 2015). The public administrations involved in the ecosystems gained a clear grasp of the situation, being pushed to reflect on how to revise its service provision and implement policies to support (public sector) innovation, sustaining an effective embedment of more inclusive and accessible solutions in the service provision. Relevant knowledge concerns how co-designing services can contribute to migrants' socioeconomic integration on the two intertwined levels of (a) developing more inclusive, accessible solutions (Concilio, Costa, et al., 2022) and (b) impacting policy-making to sustain an effective embedment in the service provision (MIICT et al., 2022). Legal and regulatory frameworks can play the role of opportunities or limitations for inclusive public service provision. How can these frameworks be adapted or reformed to promote migrants' access to services while ensuring compliance with existing laws and regulations?

Developing solutions in the four ecosystems demonstrated that benefits to boost public sector innovation derive from creating solutions hardly covered by the technological market, but also from sharing solutions and responsible practices with other administrations for integration or even developing them jointly. The discourse makes it evident that the public sector must overcome organisational dogmas to pursue innovation. From the steady integration of participatory activities to an effective engagement of multiple actors in ecosystems to the definition of requirements for producing administrative procedures and procedural documents in a way that considers migrants' needs, the public sector still needs recommendations and support to improve accessibility while lessening the administrative burden. Recommendations that advance in two directions: prompting human rights literacy and interculturalism (Cantle, 2012; Watt, 2006) in public authorities to set the ground for better practices that exploit existing technology, beyond acceptance, towards long-term sustainability.

The potential applicability and scalability of the findings from the easyRights project extend beyond the project's immediate context and the migrant population. The benefits of enhanced and citizen-centred public sector delivery are not limited to migrants alone; they can also positively impact the broader citizenry. Consequently, the project has a wider potential that could serve as a base for advancement for the overall public sector innovation domain. By recognizing the wider implications and potential transferability of the project's results, there exists an opportunity to transform public service provision to better serve all members of society, thereby warranting further exploration and investigation.

Nevertheless, here comes one of the limits of experimentation. Although it sheds light on the need for systemic change, the awareness spread within the ecosystems and its actors but reaching the top levels of decision-making for implementing procedures and services at the governmental level is a different matter.

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Creating Methodological Design Processes for Empowering Artisans of Cali, Colombia

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Abstract

This paper describes how, from an academic exercise, Industrial Design students assume the role of social *intrapreneurs* (Cabana, 2018: 90-91) to become aware of the potential of design and the richness in non-academic learning that this type of dynamics can generate. In Colombia, there is sometimes a dependency between the artisan and the designer, because some professionals hired by state entities or third-sector agencies carry out design processes for the artisans, considering their skills, but these designs are not generated in a participatory manner. What is sought with this exercise is to empower artisans through the search for a design process according to their needs, where collectively the designer facilitates the artisan the incorporation of elements of the design process proper to the design into the empirical exercise of the artisan. This way, the artisan meets the creative requirements of customers and the local market, which allows them to increase their competitiveness and not depend on the designers to achieve a product portfolio that guarantees economic, cultural, and social sustainability.

Keywords

Artisans
Empowerment
Design
Social
Methodology

Introduction

Bourdieu (2010) considers that symbolic and cultural capitals are factors for the circulation and acquisition of different artifacts, their markets determine the aesthetic judgment and, therefore, affect cultural consumption, which becomes a reflection of social status. In the case of Colombian artisans, this is not the exception, and the perception of the craft product is linked to the field to which the observer belongs and it is delimited by their educational level and social origin; the artwork makes sense for those who possess the cultural level of the code that it proposes.

In this case, the perception is linked to the field in which the customer of the artisanal object belongs and is delimited by the educational level and social origin. According to 'Artesanías de Colombia's Data, there are 31,003 artisans of which 67,2% are over 40 years old and 23,2% are over 60; 43,6% of these groups of artisans, have learned their trade through the transmission of knowledge at a family level, and only 11,4% from training institutions or governmental promotional projects. Most of them trade their products directly to the final customer (76,2% of them), stating that the main difficulty they face is ignorance regarding the market on the part of the buyers' and their preferences. Only 27.9% of that group have accessed fairs and exhibition events, which makes most artisans sell their products in the spaces where they live or in a market with a similar social origin or educational level to theirs.

In present times, and to respond to the role of the designer, it is relevant to make visible what must be done to access the most important fair and marketing showcases in the country, where there are business roundups with international purchasers and showcases focused on a knowledgeable public. This requires not only being able to pay for participating in the events but also being admitted to a selection process at a national level, where criteria such as identity, design, technical management of the trade, corporate image, marketing, and exhibition are evaluated. Out of these 5 criteria only one, that of identity, depends 100% on the traditional training of the artisan. For the other criteria, the support or accompaniment of designers and specialists in commercial and marketing issues is required. The very construction of this market model establishes a connection of reliance. (Ramirez, 2015).

Being an artisan, in a traditional sense, is to capture cultural aspects of a certain social group in an object, it is a way of writing, conserving, and protecting thoughts through objects, however, the economic system in which we live has led these groups to stop producing objects for their daily use and begin to depend on its commercialization for their subsistence due to the dynamics of accumulation and incessant productivity of the economic model that prevails today.

It is also important to review the impact that the design exercise can have on the craft sector, how much the designer can contribute to the improvement in the quality of life of the artisans, how much the designer can transform a context with so many socio-economic problems, and how far they can assume the responsibility within the commercial difficulties of cultural practice.

Socio-economic characteristics of the artisans from Cali with whom the methodological process was carried out

Currently, making an artisan product has a different meaning, because what used to be a daily activity, today is linked to a generation of income that offers the community the commercialization of its products, thus transforming the reason for being of this cultural expression. This situation has led to commercialization becoming one of the main sources of subsistence for the communities. The commercial exercise has often involved an economic mishap since the artisans are a population with a low educational level. It has been known that only 52% of the artisans completed primary school, 18% secondary school, and 3% had access to higher education. Regarding the commercial dynamics, most artisans sell their objects from their workshops and 85% do so in the local market, which has created a perfect scenario for intermediaries to obtain the most profit from this economic activity. Only 27.9% of artisans in the country have accessed fairs and exhibition events, which makes us think that most artisans sell from their living spaces and in a market that has a social origin and a level of education similar to theirs. One of the current problems of the artisan sector is the informality of their work, which leads to a constant rotation in economic activity, as well as the low supply of human resources for the growth of their workshops, little productive capacity, and a low response to market demands, some difficulty to obtain raw materials, and the low levels of education in the artisan sector. http://www.artesanasdecolombia.com.co/PortalAC/C_sector/caracterizacion_81).

The complexity of the social-economic scenario that artisans face due to their limitations to access directly to a commercial market leads us to think about how social innovation theory is relevant in inclusion and empowerment processes among social groups and vulnerable populations. Relationships between citizens and, in this case, artisans and designers in training, need to be included, evoking collaborative practices where there is an exchange of knowledge and mutual knowledge, where the designer is an agent of change that contributes to the autonomous growth of the artisan and the student acquires knowledge in social design processes. The process that has been carried out seeks the designer to be a facilitator who gives access to alternatives that contribute to the search for economic, cultural, and social sustainability in the current commercial dynamics of artisan workshops.

This exercise was carried out in two academic periods with 7 artisans, 3 women and 4 men, performing craft trades such as *mustacilla* fabric, imitation jewelry and jewelry, cabinetmaking, wood lathe and work in *guadua* (a type of bamboo). The products they develop range from large and small format decoration pieces, to fashion accessories, wooden carts, and jewelry. Out of these, 3 have points of sale located in the Loma de la Cruz Artisan Park, which is managed by the Mayor's Office and the others have their workshops in their home. In their commercial showcase are the fairs and events that are organized in the country. In all cases, handicrafts are informal and low-income jobs.

The role of the industrial designer in creative and product development processes within communities

The designer must make a cultural recognition from a community that lives in conditions of vulnerability, as manifested by Margolin (Margolin & Margolin, 2002), focusing the efforts on which the designer constantly solves problems but directing them towards those who seek a social and environmental impact through participatory design or co-design processes (Buchanan, 2004, 30-39). For Gui Bonsiepe (Bonsiepe, 2019), designing that seeks to solve problems with a social approach, is not a type of design but a position assumed by some designers and highlights the importance of more and more professionals assuming it to mitigate and control the impact of design activity.

In order to respond to the role of the industrial designer, it is important to make visible the access to trade fairs and showrooms in Colombia, where there are business roundups with international buyers and showrooms focused on a knowledgeable public. Of these 5 criteria only one, identity, depends 100% on the traditional training of the artisan; for the others, the support of designers and specialists in commercial and marketing issues is required. Given the level of training already explained, a dependency relationship is established, starting from how the dynamics between artisans and designers are conceived.

Making a review of the figures of the most important craft fairs in the country, it is still contradictory that we observe that only 3% of the artisans, from different entities and identified by the government, have worked on strengthening their productive units in the line of development of the artisan product. This is present because the projects and their activities are defined from the perspective of the designer, who evaluates and transmits the importance of considering the trends and dynamics of the global market to the artisans, but without taking the contextual needs of the population with which they work as a starting point. The company emphasizes that the design process with the community has a participatory design or co-design as principle.

Now, when talking about the concepts of participatory design and co-design, it is important to cite Manzini and Margolin. The former defines it as a new culture to guide the processes of social change that leads to sustainability (Manzini, 2015); it implies a socio-technical transformation driven by social change and incorporates all the related actors. While for Margolin (2017), the word social must seek the well-being of all; therefore, designing with this approach is a practice committed to a better world from a formal and functional response to a specific situation and context (Margolin, 2006).

García (1982) proposes to interpret the conflicts suggested by capitalism in the development of cultural practice, in search of answers about the distance between producers, marketing channels, and boutiques, which for this case would be artisans, artisanal marketing highlights, and the workshop. He also questions why communities increasingly tend to produce for a trade to which they have no access, other than for local consumption. It is where they directly manage to generate income, questioning within that busi-

ness culture what economic and symbolic are related to what is sold and desired by the artisan, the designer, and, in this case, the government company that gives the political guidelines.

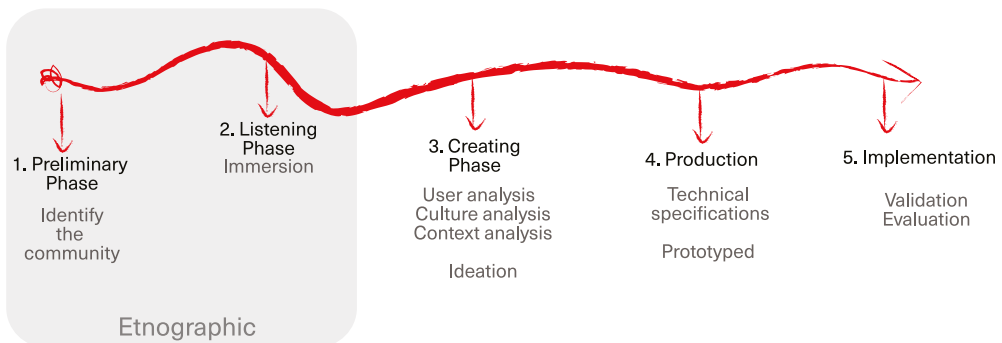
Participatory design methodology for the empowerment of the creative and commercial artisanal process

The project was born as an academic exercise for fourth-semester students of the industrial design program of the *Universidad Autónoma de Occidente in Cali*, Colombia. Instances of collaborative work with the community, in this case, the artisans, are defined to meet specific needs.

The Universidad Autónoma de Occidente has a social projection plan, as one of its three missionary activities. It is important, within the Faculty of Architecture, Urbanism, and Design, to generate projects that allow a symmetrical relationship between the academy and the communities, for the collective search for solutions to social, environmental, cultural, or economic problems. All this is through participatory processes that reflect the socio-cultural sensitivity of the actors involved. The conception of ideas and their materialization is developed collaboratively, generating a direct link between the disciplines' expertise and the community's needs.

Through an ethnographic approach, the students identify the context and culture of the artisans to minimize possible negative impacts on issues of social sustainability of the project and its design, to guarantee that the co-design phase is enriched and adequately developed among all parties. From the latter, the technical requirements are focused on their coherence about the culture, the context, and the artisan's design language in which object terms are produced, generating an appropriation of the methodological processes by the artisans in return. Having these requirements established, the co-design stage begins and the product development alternatives are recognized through the Ideation-Doing processes. This goes hand in hand with the analysis of the object as a sign, in terms of object language (Sanchez, M. 1998), allowing the connection with the formal response and the elements of the artisan's symbolic meaning. The students then collect the information and validate with the artisan the elements of use and perception that arise from the proposed design process.

Tab. I
Social design methodological process.
Note: This is a descriptive graph of the social design methodological process combining Design Thinking and Human Centered Design phases.



The process begins by making a preliminary approach to the artisan with whom you are going to work, and it is offered, as an identified need, that the artisans can do the exercise of design and commercialization with their clients of the local market in an autonomous way. Taking this premise as a starting point, students perform various ethnographic key activities to the development of the listening phase which is an immersion in the context, based on the Ideo Toolkit (Ideo, 2011) and The Toolbox of the Young Researcher (Létourneau, 2007). Here, there is an approach to various actors in the context of the artisan, such as relatives, suppliers, and customers, among others. After that, the students begin the ideation phase, analyzing and synthesizing the information collected. They define what they identified and they must approach the project and begin with the exercise of co-design with the artisan. Both, hand in hand analyze the step by step of the design process, which in most cases occurs by producing or manufacturing pieces without a sketch or previous proposal. In this exercise, it is crucial that students together with the artisan to enrich the design process and find points of convergence where moments of design can be incorporated, but coherent with the culture of the artisans. The artisan-designers team defines which aspects to potentiate, which ones to conserve, and which of them can perhaps be eliminated. In this way, a methodological design is defined for each of the artisans, including both the design process of each craft workshop and the tools for marketing; it allows the artisans to identify tastes, requirements, and needs that the local client manifests when requesting a customized craft.

In some cases, at the request of the artisan, moments of trend analysis were incorporated into search engines and colorimetry, so that artisans need to be updated with the dynamics of the market.



Fig. 1
Presentation of the product designed by students and the artisan.
Note: Students Sofía Acevedo, Felipe Gaviria, and Manuela González with the artisan Octavio Toro. 2021.

Once the design is defined by the artisan, the production phase is carried out; each group of students makes the inputs that are required so that the artisan in his workshop and according to his daily activities can implement the designed methodology. Some develop adaptable primers and notebooks with tools and supplies, others develop tiles and boards like those in the monopoly game,

and others design a surface with interactions so that the artisan finds all the tools in one place. Each response varies according to the tastes and needs of each of the artisans.

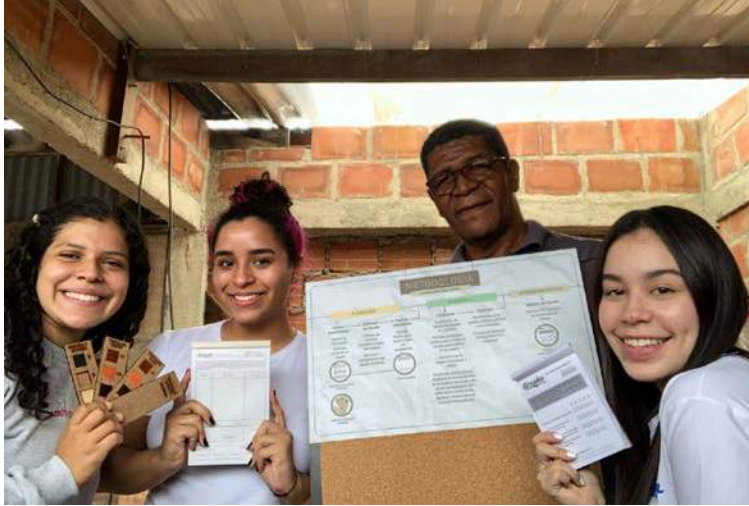


Fig. 2
Products designed by students and the artisan.
Note: Pre-production of a methodology for the artisan Wilfredo Méndez.



Fig. 3
Presentation of the product designed by students and the artisan.
Note: Delivery of the methodology Carnauba to the artisan Jaime Gonzales 2021 by the design team.

Once the delivery of the methodological material finishes and is socialized, the artisan and the group of students validate the methodology and design a new object. This is to identify if the proposed solution responds to their needs and if it empowers them in the design process, to continue constantly creating new products for their workshop.



Results and Conclusions

The result of the academic process was the structure of seven artisan design methodologies. In aspects such as the artisan client relationship, the creative process, the search for market trends and requirements, and improvements in the production process to be strengthened, which sometimes went hand in hand with the object design development.

This process also allowed the students to connect with a real community, learning from the experiential way in which others generate creative proposals, in addition to know other realities that permit the learning of social design.

Artisans need to be able to empower themselves with their artisanal development process; hence, they can be part of the commercial dynamics, as well as achieving the sustainability that is required for the conservation and strengthening of this cultural practice.

The co-creation work between students and artisans allows for a greater degree of appropriation of the symbolic value of the artisanal objects, guaranteeing an appropriation by the artisan so that once the designer is not there, he can implement it.

Incorporating design processes in the artisan value chain improves the competitiveness of handmade products and, thus, their participation in trade fairs and events.

In all the methodologies proposed, based on industrial design strategies, there is a clear unity between the phases of inquiry, ideation, and implementation with the artisan processes. The value of these methodological proposals then lies in the way in which students appropriate the steps to follow and connect them with the needs of their client-user.

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Fig. 4
Validation with the development of the design and production process of a new product.
Note: Creative exercises with the artisan Edith Meza.

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Empowering Through Design: Regional Development Strategy of Los Lagos as an Intersectional Case

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Abstract

The territory is configured as a space that is limited, occupied, and used by different actors. From these, diverse relationships of complementation and reciprocity but also conflict and confrontation are generated in the form of complex systems, making the territory a “system of systems” (Luràs, 2016; Jackson & Keys, 2019). It evokes the concept of intersectionality, as it is used to designate the perception of power relations, putting in doubt the existence of empowerment of certain less favored actors. Systemic design is a practical-methodological-theoretical field where systems and design thinking and practice converge to address the complexity of citizen participation as the relationships of various elements, having multiple foci, considering these elements as human or non-human from a territorial point of view. Service design proposes that the actors of the ecosystem are considered “users” and “co-producers” of the service since all of them interact with the DRA at some level. Through co-production and co-creation techniques, around 30 community citizen online workshops and 16 participatory webinars were carried out. The objective of these workshops, in addition to contributing to the elaboration and adjustment of the diagnosis and Design of the Regional Development Strategy (ERD) of Los Lagos, Chile, seeks to generate social innovation. The use of databases and various media made it possible to design workshops in remote mode, which achieved effective participation of more than 2,000 people.

Keywords

Intersectionality
Empowerment
Systemic design
Regional planning
Co-creation methodology

Concepts

The territory is a concept that has been part of the theoretical field in the various currents of geographical thought. It is formed by an indissoluble, supportive, contradictory set of object and action systems, considered the unique context in which history takes place (Llanos-Hernández, 2010). The territory is configured as a space that is limited, occupied, used, and appropriated in different ways by human and non-human actors, linked to the field of power over this space exercised by the dominant actors, who usually tend to be human and its interest (Capel, 2016; Beuf, 2017). From these, diverse relationships of complementation, reciprocity, conflict, and confrontation are also generated (Nates Cruz, 2011). Therefore, the territory is a "system of systems" (Lurás, 2016), acting as a container of various interlocking systems whose boundaries overlap and form a system.

Understanding the above, territory evokes the concept of intersectionality, as it is used to designate the perception of power and oppression relations and systems (Viveros Vigoya, 2016). The concept of intersectionality is a critical analytic and theoretical framework in the premise that human experience is jointly shaped by multiple social positions, such as race, gender, and social class, and cannot be adequately understood by considering these social positions independently (Al-Faham, Davis & Ernst, 2019; Cooper, 2016; Bauer et al., 2021). It considers the heterogeneity through different intersections of social positions, and it is integral to understand social experiences (Bauer et al., 2021). It is in the territory where the relations and systems of domination that influence human and non-human life are manifested. In territorial planning, the population living in the territory and the existing natural elements are often left aside, which increases the complexity of the problem if their needs are not heard, or even possible solutions that arise from them. There is, therefore, uncertainty as to whether planning can provide real solutions to these disputes, and that is why there is a need to position itself interdisciplinary in order to understand this type of complexity (Grabe, 2020).

To provide further empowerment to the actors less favored by the land, an interdisciplinary approach has articulated the disciplines of Design with those that have historically been more involved in territorial planning. There is a consensus around the idea that acting in a group, in a community way, allows individuals to obtain more advantages than they could achieve if they worked individually. From an ecology of design (Orr, 2002), it is possible to maintain that the development of certain groups is not only explained from their human dimension (knowledge and skills) and an economic dimension (production of goods and services) but also from the strengths in the social bonds of these communities. Therefore, improving social ties in the community, based on the construction of a network of community contacts in the territory, strengthens trust and allows it to achieve its objectives.

From this perspective, the involvement of users in regional planning is a challenge that is of particular interest to the disciplines of service design and system-oriented design (DOS). On the one hand, service design is a holistic and practical field of research that allows services and experiences to be improved (Miettinen &

Sarantou, 2019; Moritz, 2005), based on the analysis of the “interactions between people who cooperate to produce a common and recognized value” (Manzini, 2009, p.45). Service design considers users not only from a theoretical point of view but above all practical, including all stakeholders in its processes, conforming from a systemic and multidisciplinary approach to the creation of useful, usable, and desirable services. The authors emphasize the need to focus on the user using co-creative methodologies, always maintaining a holistic view of the process. In this way, service design focuses on interactions (Stickdorn & Schneider, 2012), while systemic design (DS), with its focus on systems-oriented practice (Sevaldson, 2017; 2019; Sevaldson & Jones, 2019), contributes to strengthening the reciprocal relations between the actors of the ecosystem of users of the project.

Empowerment is understood as a process by which communities have greater control over their lives based on capacities acquired in each context (Silva & Martínez, 2004). It is conceived as an instrument of change and transformation to give attributions to disenfranchised people about their capacities and dynamics of power (Rigaud, 2020). It is related to social innovation, which establishes new ways of social relations including new ways of doing, organizing, framing, and knowing. It evolves to system innovation through a process of structural change in a superior societal level (Avelino et al., 2019). The territory problem requires finding an intermediary factor that facilitates and integrates needs, demands and opinions to promote true empowerment.

Through the experience of participation in the Regional Development Strategy (ERD in Spanish) of the Los Lagos Region in an adverse context such as the pandemic, the strategic Design has become an essential factor. The five principles of service design: i) user-centered, ii) co-creative, iii) sequenced, iv) evidenced, and v) holistic (Stickdorn & Schneider, 2012) and the focus on solving complex design problems systems-oriented (DOS) (Aguirre, 2020) are a critical factor in achieving a collaborative, distributed, situated, open and resilient process.

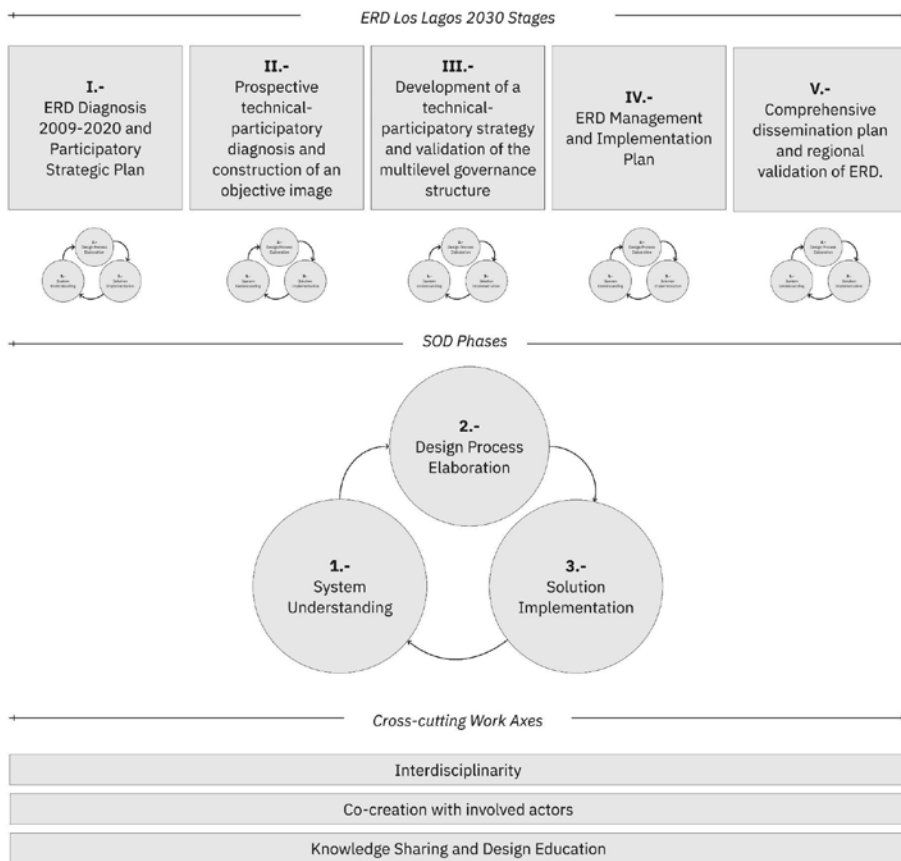
Methodology

Through co-production techniques, understood as the provision of services in an egalitarian and reciprocal relationship between actors (Boyle & Harris, 2009), and co-creation, which is an act of creativity that is shared by two or more actors (Sanders & Stappers 2008), around 30 community citizen workshops and 16 participatory webinars associated with different territorial divisions were carried out. The objective of these workshops, in addition to contributing to the elaboration and adjustment of the diagnosis and Design of the ERD, seeks to generate social innovation, understood as a participatory public leadership that creates innovative solutions aimed at resolving social needs and that change social relations (Conejero Paz & Redondo Lebrero, 2016).

The methodology for the different instances of participation considered the “Design for Public Services” approach of the Public Innovation Laboratory (LIP in Spanish) of the Pontificia Universidad Católica de Chile. This model proposes that the actors of the ecosystem are considered “users” and “co-producers” of the service since all of them interact with the DRA at some level (LIP, 2017). The techniques and instruments used are qualitative and allow the free expression of the participants but focus on obtaining results (Godet & Durance, 2007). In other words, they can be systematized and contribute to the co-creative process of the ERD so that citizens take ownership of the results and always feel like co-producers (Lip, 2017). On the other hand, Service design and co-creation methods propose that the actors of the ecosystem are considered “users” and “co-producers” of the service since all of them interact with the DRA at some level (LIP, 2017; Alford & Freijser, 2019).

This methodological approach also considered the perspective of systemic design (SD) and systems-oriented design (SOD). SD is a practical-methodological-theoretical field where systems and design thinking and practice converge (Sevaldson & Jones, 2019). As an open and continuously developing praxeological field (Cross, 1999), it facilitates the multiplicity of perspectives and disciplines and their integration, which becomes tensions that provide space for creativity, collaboration, and complex problem solving (Ryan, 2013; 2014; 2016). SOD as a praxeological subfield (Selvadson, 2019) understands complexity as the relationships of various elements, having multiple foci, considering these elements as human or non-human from a territorial point of view.

The methodological strategy for the elaboration of the ERD 2020-2030 was organized in the following stages: i) Diagnosis of ERD 2009-2020 and participatory Strategic Plan; ii) Prospective technical-participatory diagnosis and construction of an objective image; iii) Development of a technical-participatory strategy and validation of the multilevel governance structure; iv) ERD management and implementation plan; and v) Comprehensive dissemination plan and regional validation of ERD. With 30 community workshops and 12 complementary workshops, more than 300 people participated, and the problems were addressed from the perspective of cities (5 workshops) and strategic areas (7 workshops). Work was carried out on the prospective diagnosis, the definition of the objective image, and the elaboration of the strategy in co-creation with the citizens, the sectorialists, and the regional government officials. For the co-creation and co-production process (Jackson & Keys, 2019) of the ERD through effective and binding participation, the work was approached from the SOD (Sevaldson, 2022) through its 3 phases.

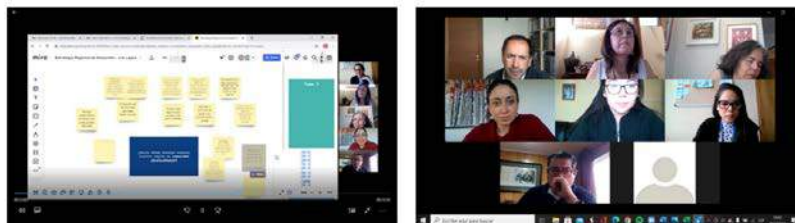


Phase 1: System understanding.

In the first phase, the problem of framing is addressed, which establishes the limits, the actors, the components, and the relationships involved in the project's development.

Fig. 1
ERD 2030 methodology
frame crossed with
Sevaldson's SOD method-
ology approach.
Source: by own.

Figura 73. Registro de algunas de las actividades realizadas Taller Regional



Fuente. Elaboración Propia, 2020

Fig. 2
Problem framing work-
shop with citizen actors
from territories.
Source: ERD Los Lagos
(2021).

A continuación, se muestran imágenes de la actividad realizada:

Figura 65. Registro de algunas de las actividades realizadas Taller GORE



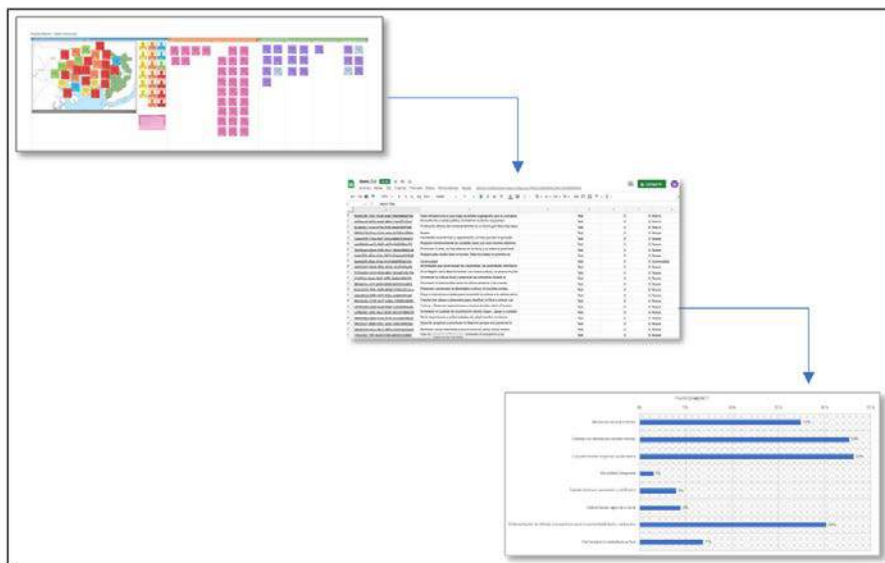
Fuente: Elaboración Propia

Phase 2: Elaboration of the Design Process

In the second phase, the system analysis ecosystem where the solution will be implemented is holistically addressed, including data collection and analysis that identifies and observes the variables and interactions that influence the system's behavior and how they do so. Identifying those points of influence with which the applied research project will work is critical. The data collected in the workshops with citizens, sectoralists, and regional government actors were processed in this phase.

Fig. 3
Problem framing workshops with governance actors.
Source: ERD Los Lagos (2021).

Figura 1. Esquema de la secuencia metodológica para el análisis de los talleres comunales



Fuente: Elaboración propia. 2021

Fig. 4
Data Collection and analysis. Methodological sequence frame for citizen workshops results analysis.
Source: ERD Los Lagos (2021).

Los conceptos más mencionados en los dos grupos de trabajo realizados corresponden a:

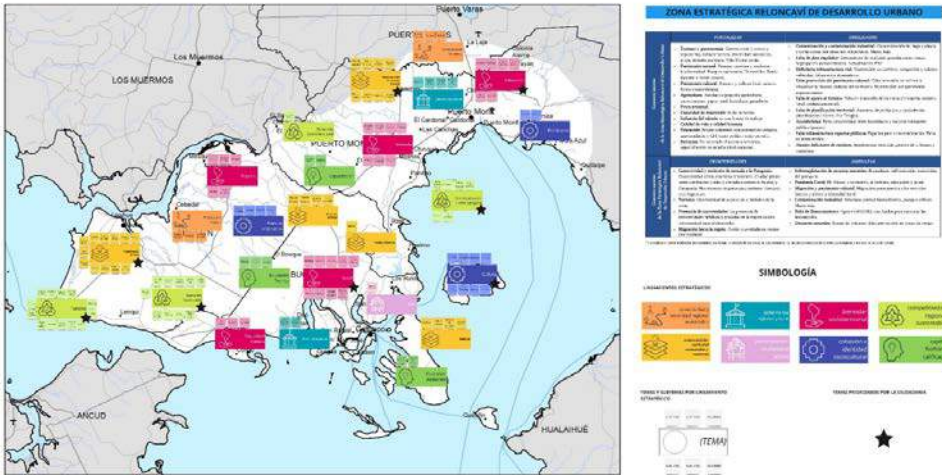


Fig. 5
Data Collection and analysis.
Word clouds used to understand which are the main concepts for citizens from each territories.
Source: ERD Los Lagos (2021).

Phase 3: Solution implementation

In the third phase, the design intervention development focuses on the imagination of the preferable scenario and the creation of value of the design project in development, referring to the effect that it will generate on the context. In this phase, based on the survey carried out with the citizens and the sectorialists, the Regional Government actors determined the components of the regional strategy.

Figura 43. Mapa ZE Reloncaví de Desarrollo Urbano, FODA y Temas prioritarios de la ciudadanía, por lineamiento



Fuente: elaboración propia.

Fig. 6
Priority issues for citizens by guideline.
Source: ERD Los Lagos (2021).



Finally, in parallel and constantly, a process of knowledge sharing, and design education is addressed within the interdisciplinary team that manages the project with the actors involved.

According to Sevaldson (2022), “Interdisciplinary, transdisciplinary, and cross-disciplinary work are a natural consequence of the complexity addressed in SOD. We are frequently dealing with unfamiliar realms, and learning becomes a continuous and integrated part of the SOD practice” (p.348). In the ERD participations, multiple disciplines converged in which Design acted as a facilitator, not only among them but also among the actors. In the participatory instances, the territory was analyzed as a system of systems (Lurås, 2016; Jackson & Keys, 2019), highlighting each system in its dimension or “central” element and the interrelationships between them.

Fig. 7
Co-creation and co-production process for ERD management strategy implementation plan.
Source: ERD Los Lagos (2021).

Results

The use of databases and various media such as radio and social networks made it possible to design workshops in remote mode, which achieved effective participation of more than 2,000 people. This participation is reflected in the number of attendees and the active participation of each one in the different instances of the meeting. Everyone had the opportunity to express and share experiences, perceptions, and opinions in a space of mutual respect. In addition to the oral interventions, this space was diverse. The participants left questions, comments, and suggestions in the chat and synchronous surveys through the digital tools.

This implies empowerment (Rigaud, 2020), but with a focus on balance because each participant represented the diversity of the population present in the region, within the framework of an intersectional work (Al-Faham, Davis & Ernst, 2019). In other words, actors who generally have less political and economic power were given a voice and therefore could participate in a balanced way with other actors who have historically had a more significant impact on the region’s growth and development. This balance went beyond generating a diverse, inclusive, and fruitful space for dialogue for the ERD. It also meant providing capacities both in territorial planning issues and the use of digital tools to all stakeholders of the ecosystem.

Both the methodology and the participatory process made it possible to identify different types of systems, such as territorial, actors, actions, and results, as the conclusion of quantitative and qualitative methods from different disciplines (Bauer et al., 2020).

The preceding is linked to the territory's complexity and how a dynamic objective vision is co-perceived and co-constructed. The requirements of this work focused on participation with a systemic approach, the articulation of sectoral institutions and professionals, the interdiscipline of the base team (Grabe, 2020), and the digital strategy due to the pandemic.

The actors' systems directly involve the inhabitants are the most relevant. Through participation, they confirmed specific issues of the territory raised in the diagnosis. Nevertheless, they identified and highlighted new ones. The demands, needs, and conflicts also proved to be unique, representing the existence of other systems and subsystems. For example, the actors suggested several elements to be considered in the regional vision, such as sustainable development, protection of natural wealth, guaranteeing the dignity and integrity of each inhabitant, territorial integration with the maritime space and mountain systems, among others. Therefore, the actors revealed the positions and power relations that are persistent in the territory (Bauer, et al., 2020), together with the consequences and challenges associated with the regional planning (Orellana, Arenas & Moreno, 2020). The recognition of the needs translated into a joint and consensual vision of regional development, which in turn was reflected in a strategy that contains guidelines, objectives, and specific goals.

In this context, the strategic intervention of design reveals the innovative potential of collaboration based on co-creation and co-production, where the ecosystem's actors should not only be summoned to give an opinion but also to co-construct the development and design of the ERD (Alford & Freijser, 2019). The value of activating heterogeneous and distributed networks throughout the territory is recognized, promoting the free exchange of knowledge and skills between the different communities that define their ERD. In this sense, participatory citizenship is related to "resilience" (Graveline & Germain, 2022) since the process allows people to learn together, supporting experimentation and increasing the potential for (social and technological) innovation (Jeans et al., 2016). Some achievements in the process include identifying the specificities and situated needs of the territories, interpreting the socially diverse realities, and developing solutions consistent with the requirements of the communities the ERD will address. Additionally, the need to promote transparency in the process is recognized, opening participation to the community not only in the final stages but also from the beginning of updating the ERD. Finally, it is recognized the importance of developing an ecologically sustainable update process for the ecosystems (environmental, economic, social, cultural, political) that the ERD articulates. These attributes emphasize the role of systemic design and service design as a regenerative and resilient catalyst toward more sustainable and inclusive futures. In summary, the synthesis of new knowledge allows the potential creation of a transdisciplinary methodological strategy (Sevaldson, 2022)..

Conclusions

In conclusion, several lessons can be drawn. The first is that the elaboration of an ERD is a space of intersectionality, in which different actors must converge and, therefore, power relations must be balanced since everyone was aiming for a common good (Bauer et al., 2020). Second, an ERD requires intense work with and among the team of regional government professionals, who have different agendas to fulfill. Third, an ERD, by its nature, must be participatory throughout the process and not only consultative in the validation of the outcome. Finally, an ERD requires intensive work with sector professionals who represent different systems and have different expectations from the central government (Sevaldson, 2022).

Preparing the ERD implied various exhaustive quantitative and qualitative analyses, also co-creation processes (LIP, 2012) as are suggested in intersectionality research (Bauer et al., 2020), which were evaluated by the critical actors in the region, including the inhabitants through actions of empowerment (Rigaud, 2020). The feedback came through the reactions and corrections, adjusting the problems and possible solutions. Thus, the formulation of the instrument's initiatives was a decision-making process. In other words, it was an integrated co-creation and co-production work (Alford & Freijser, 2019) to understand and comprehend the relations and conflicts that generated the problems in the territory.

For each of these challenges, the incorporation of Systemic Design (Sevaldson, 2022) and Service Design (Miettinen & Sarantou, 2019; Manzini 2009; Moritz, 2005) as disciplinary approaches and as methodologies for co-creation and co-production with the user in the process of developing an ERD is a novelty since these are spaces that have traditionally been inhabited by economists, architects, engineers, and urban planners, among others (Alford & Freijser, 2019). ERD methodologically measured by the discipline of Design transforms a traditional process of elaborating a territorial planning instrument into social innovation, as the Design contributes to solving the different needs and demands with innovative and democratically designed solutions.

Therefore, it is possible to contribute towards the formation of a new transdisciplinary approach (Sevaldson, 2022) that allows territorial planning deal with the complexity that requires: first, guiding the processes towards a binding and creative participation of the population in instruments linked to decision-making; and second, sharing and taking in mind the experiences, perceptions, expectations, and interactions of the different kinds of territory actors, which also include the variety of socioeconomic backgrounds.

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Inclusive Merchandising. A Storyteller for an Accessible University

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Abstract

Following recent social and global transformations, cultural organizations have undergone a major redefinition in their role as keepers and promoters of knowledge and heritage, developing virtuous examples and reference models for the free, open, and autonomous enjoyment of all audiences. This contribution - contextualized in a current doctoral research on the enhancement of cultural heritage, promotion of institutional and territorial identities - is presented as a reflection on the recent awareness and attention to the issues of inclusiveness and accessibility in places of culture, especially higher education institutions. Through an analytical work on numerous university case studies, focused on institutional merchandising products, it was possible to outline common attitudes and effective communication strategies that promote core values related to multiculturalism, body positivity, gender equality, women's empowerment, and integration of ethnic minorities.

Keywords

Accessibility
Cultural Heritage
Diversity
Higher Education
Inclusivity

Free access and enjoyment of cultural heritage by all individuals is recognized in the Article 27 of the “Universal Declaration of Human Rights”, emphasizing the importance of collective participation in cultural, artistic, and scientific life as a dynamic process in continuous evolution (United Nations Publications, 2018).

In order to guarantee this fundamental right, places of culture are challenged to repropose their resources in an accessible and comprehensible way to a wide variety of possible users with different needs and expectations (Falk, 2016; Sarraf & Bruno, 2013).

The transition from a merely conservative approach – intended as protection and safeguarding – to an active and engaging perspective has opened the door to the topics of inclusiveness and accessibility, giving a new social role to cultural institutions:

The concept of museums and, in general, of cultural heritage is shifting from simple exposition and preservation of the history and traditions of a culture, to that of a participative and inclusive space where culture is not only “consumed”, but also collectively created through the experiences and points of view of the public. (Muscarà & Sani, 2019, p. 245)

Many of these cultural organizations are currently moving towards common objectives to guarantee a fair, open, and autonomous access to the offered resources, also responding to the policies promoted at national and international level. For instance, The European Framework for Action on Cultural Heritage is a valuable example for the promotion of an integrated and participatory approach to cultural heritage, and the contribution to its adoption across European policies. One of the outcomes of the proposed actions included in the report is the initiative *Heritage. All-Inclusive!*, promoted in the context of the European Heritage Days 2021¹. Institutions from 50 countries were involved through the organization of more than 70 thousand events such as exhibitions, seminars, and workshops designed for a wide audience.

In this occasion, many actions concerned the removal of barriers (physical, linguistic, cognitive, sensory, cultural, economic or technological) that hinder participation, considering a broader definition of “diversity” (Cetorelli & Guido, 2017; Olivares & Piatak, 2021), determined not only by physical conditions, but also by cultural ones (geographical origin, religious faith, level of education, etc.) and social ones (gender, salary, dietary needs or habits, etc.).

By widening the concept of diversity, new tools and objectives are established to improve the dialogue and relationship between cultural institutions and audience:

Inclusivity and exclusivity are neither abstract nor absolute qualities; they can only be measured according to specific socio-cultural relationships. Key among those is the ideological performance of the museum as exemplified in its collections and programming activities, and by the specific narratives privileged by the museum and shared with specific sub-groups, classes or strata within the population as a whole. Integral to this performance are both the museum’s presentation and the visitor’s interests, which constitute distinct coordinates within a connecting matrix of culture practices. (Coffee, 2008, p. 271)

Another highly topical aspect is the digitization of cultural heritage (Borowiecki et al., 2016; Fanea-Ivanovici & Pana, 2020) and its fruition through virtual tools and platforms enabled by new technologies (such as virtual reality, augmented reality, additive manufacturing, etc.). While, on the one hand, this approach allows broader access by offering personalized and original experiences - as proven by numerous initiatives during the Covid-19 pandemic (Ginzarly & Srouf, 2022) - on the other hand, it can create new discrimination caused by the digital divide - understood as the gap between those who have access to digital technology and those who do not - reinforcing economic, educational, and social inequalities.

The narrative side of universities and higher education institutions

Cultural sites can be considered not only those with historical, artistic, and architectural value such as museums, archaeological sites, and cities of art, but also contexts for production and transmission of knowledge such as universities, higher education and research institutions (Sebastiani, 2007).

These specific organizations play a complex role as bearers of values that directly affect their communities as people. One of their tasks is to communicate and enhance goals, policies, and practices undertaken for the well-being of all in terms of equality and inclusion, with special attention to vulnerable groups and minorities (Jucevičienė et al., 2018).

In particular, the so-called University Third Mission seeks to transfer knowledge outside academic environments to create a social, cultural, and economic impact:

All third mission actions are carried out in the belief that the prerequisite for the socio-economic development and growth of a region is the ability to trigger 'virtuous co-evolutionary circles' between research, education, technology, business, and services, thus, fostering the enhancement of the intangibles represented by the social capital of a region (e.g., culture, traditions, environment, lifestyle, social inclusion, and cohesion). (Fronzizi et al., 2019, p. 23)

Hence, the success of the objectives dictated by the Third Mission is not only defined by the direct actions undertaken by the university in benefit of its external context, but also by its ability to narrate its results to the stakeholders and the general public.

Among the various storytelling tools available to convey messages and values, merchandising is gaining consideration and interest. It can be found in all cultural contexts that aim to disseminate knowledge also beyond the direct interaction with the visitor. Merchandising – intended as a system of useful products, bearers of meaning – is one of the elements constituting the institutional image Fig. 1.

It conveys a message rooted in the institutional identity, consisting of cultural heritage, mission, and values. This message is then delivered to an audience that establishes a relationship with the institution, influenced by the perceived value that stimulates a sense of belonging or identification.

We can talk about the rise of a more entrepreneurial vision within higher education institutions:

Marketing and merchandising can be seen as specific entrepreneurial ventures carried out by universities to reposition their reputation around the world, a way to expand connections with external stakeholders, to approach new market demands and, in terms of future perspectives, to become students' first choice; in other words, to distinguish themselves from competitors, just like enterprises do. (Fantauzzi et al., 2019, p. 5).

In addition to its undeniable relevance from a communication and marketing point of view, the merchandising object also has a strong symbolic value. If in the museum context it is a tangible witness of the visit, allowing to evoke and extend the memory, in the university context it assumes a dual significance: for internal users, it becomes the emblem of an experience prolonged in time, influenced by the sense of belonging and identification (Gambardella, 2019), while for external users, it represents an element that contains the university's values.

Methodology

The presented work is part of a doctoral research focused on the enhancement of communication through new processes and strategies for the development and distribution of dedicated merchandising in university and polytechnic environment.

The exploratory analysis (Yin, 2017) aimed to identify virtuous examples of universities' integrated communication and merchandising strategies, with a particular emphasis on the ability to communicate their cultural heritage, mission, and values. It was carried out with the profiling of 150 universities (50 Italian, 50 European, and 50 extra-European). The selection of case studies was based on a geographical distribution criterion with a first focus on the Italian context, gradually expanding the scale of the investigation to a global level. The intent was to select a wide variety of institutions with high reputation and transversal research areas, exploiting university rankings such as the QS World University Ranking. Unfortunately, in some cases, no information could be found on the presence or absence of university merchandising initiatives. For this reason, universities that did not activate or promote documented activities were not included in the mapping.

All the included information was obtained from the official channels of the various universities (website, social profiles, publications) and, for the Italian cases, from online journalistic articles.

The goal was the definition of a map of different strategies, merchandising products, and communication languages, identifying peculiarities and common approaches to the enhancement of cultural heritage and institutional identity. The profile of each university was structured compiling a three-level analysis: university context, merchandising system, and products Fig. 2.

The first level summarizes the main characteristics of the analysed university, with a focus on the identity elements that become the content of the narrative through merchandising. In par-

ticular, it reports: year of foundation and motto (important for measuring the history of the institution through past and future anniversaries), type of institution (recognizing different communication choices between public and private ones), schools and faculties (identifying key disciplines of teaching and research, and the possible presence of internal resources with design and management skills related to merchandising), visual identity (as a fundamental element for recognizable institutional communication through graphic and chromatic choices), and cultural heritage (as a generative element of the narrative starting from the presence of locations and historical architecture, links with the city and/or territorial context, references to works of value and affiliations with other institutions, illustrious lecturers and alumni, etc.).

The second level covers the merchandising system related to the management of development, production, and distribution of goods, analysing merchandising objectives, product categories (clothing, accessories, stationery, gift items, typical foods), sales channels and distribution, purchasing facilities, sales management, use of proceeds (when declared).

The third level focuses on specific merchandising items and collections with their tangible and intangible qualities - such as materials, production chain, possible certifications, co-branding actions, collaborations with local organizations - and all the aspects that make them bear values. Through a semiotic and content analysis of the objects (Muratovski, 2016), it was possible to identify when the communication strategies consciously used elements of the university identity: by defining relevant categories, it became clear which elements were emphasized and which audiences were addressed Fig. 3.

Communicate university values through merchandising: some examples

The results of the exploratory analysis led to the definition of different categories of content conveyed by merchandising, highlighting which messages are preferred in university institutional communication Fig. 4. Heritage-related narratives remain the main theme used to emphasize competitive differentiation and the definition of a historical identity that is synonymous with prestige and quality, in accordance with the concept of heritage university (Lombardi, 2015).

From the values point of view, universities privilege aspects linked to distinctiveness - through the reproduction of motto, coats of arms, identity graphic signs, institutional colours - and those linked to environmental sustainability, often involving the promotion of virtuous behaviours and the reuse of resources. Despite a growing diffusion of initiatives related to inclusion and accessibility, the research has shown that the desire to communicate these university core values has not fully expressed yet its potential through merchandising products, finding only a few representative examples, strongly influenced by their cultural contexts. The identified case studies are consciously developed and effectively communicated through collections or single products, linked to important topics such as multiculturalism, body positivity, gender equality, women's empowerment, and integration of ethnic minorities.

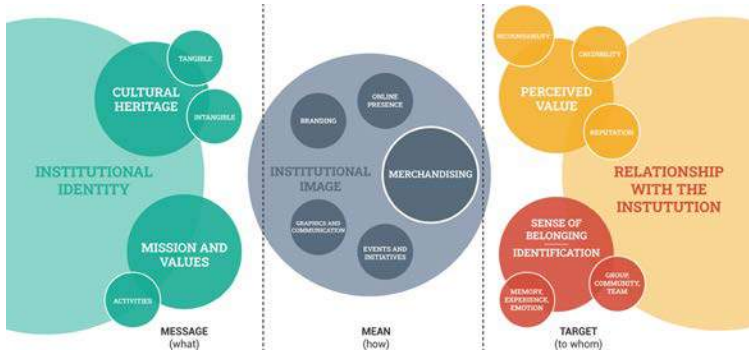


Fig. 1

Fig. 1
The role of merchandising in institutional communication. Credits: Authors.

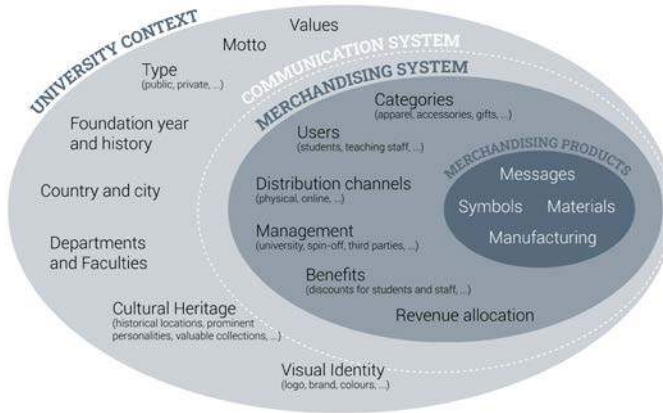


Fig. 2

Fig. 2
Levels of analysis defined during case study profiling. Credits: Authors.



Fig. 3

Fig. 3
Categorisation of themes emerged during the semi-otic analysis of merchandising products. Credits: Authors.

Specifically, two main attitudes were identified Fig. 5. In some cases, the university recognizes itself as an active player promoting internal initiatives aimed at its community (students, lecturers, etc.). The first approach can be seen in the merchandising collections of Free University of Bolzano (Italy), University of Basilicata (Italy), KTH - Royal Institute of Technology (Sweden), and The University of Queensland (Australia).

In the Italian context, the Free University of Bozen-Bolzano, founded in 1997 with the motto “Trilingual and intercultural”, adopts an interesting approach. Its strong multicultural identity, also fostered by the partnership with the Autonomous Province of Bolzano, is expressed with coherence and uniformity in the official product line² that enhances the territorial context without limiting the universality of the message. In fact, the unisex clothing and the presence of the three official languages on objects such as mugs, and kitchen aprons embody the open and multicultural spirit.

Once again, in Italy, the University of Basilicata offers a collection of unisex clothing linked to body positivity. Sweatshirts and T-shirts bear the motto *I am perfect the way I am*³, promoting the inclusion of all sizes and shapes and the acceptance of one’s own body, a theme particularly suitable for the age group of university students.

On gender equality issues, the *Giants*⁴ awareness campaign, launched in 2015 and promoted by the Swedish KTH, aims to promote female enrolment in engineering courses through the example of renowned personalities such as Hedy Lamarr (American inventor), Ada Lovelace (English mathematician), and Edith Clarke (American electrical engineer). The initiative, based on communication strategies and events, included the distribution of dedicated merchandising such as cotton shopping bags with the campaign motto “The future is too important to be left to men”.

In the context of integration of ethnic minorities, the example of The University of Queensland in Australia stands out, devoting an entire collection of institutional objects to the theme of reconciliation⁵, confirming its commitment to the Reconciliation Action Plan⁶. The painting *A Guidance Through Time* by Aboriginal artists Casey Coolweel and Kyra Mancktlelow, inspired by the reconciliation between Aboriginal culture and university values through a pattern that recalls the Brisbane River, has become the graphic element that personalizes a wide range of objects including water bottles, ties, and notebooks. The entire collection is produced by a certified indigenous supplier, and the proceeds from sales contribute to scholarships for Aboriginal and Torres Strait Islander students.

In other contexts, the university promotes social initiatives carried out by cooperatives and associations that work to contrast discrimination and increase inclusiveness, becoming a strategic partner for the dissemination of these initiatives to a wider public. This second approach can be seen in the merchandising collections of IUAV – University of Venice (Italy), University of Bern (Switzerland), University of Glasgow (UK), and Brown University (USA).

2
<https://www.unibz.it/it/home/press/unishop>

3
<https://www.unibastore.com/prodotto/felpa-perfect-the-way-i-am/>

4
<http://www.kth.se/giants>

5
<https://uqshop.com.au/collections/rap-a-guidance-through-time>

6
University’s document of intent aimed to acknowledge the participation and inclusion of Aboriginal and Torres Strait Islander in higher education through different actions.

The *Malefatte Collection*⁷, proposed by the Italian IUAV, includes bags and pencil cases made of PVC recovered from the advertising banners of Athenaeum events. Each product is a unique piece, made in collaboration with the social cooperative Rio Terà dei Pensieri, which is involved in the rehabilitation of inmates of the men's prison of Santa Maria Maggiore.

The University of Bern is taking part in the international Blue Community project for the responsible use of water, and this commitment is reflected in a specially designed merchandising product. Specifically, the Blue University carafe⁸ is made of recycled glass and its production is handled by the Glass Design Competence Centre, a social integration initiative for the training of unemployed people.

Social engagement related to issues of inclusion and women's empowerment were promoted by the University of Glasgow through a partnership with the charity Chifundo & Chanasa, by selling a collection of shoulder bags, made from recycled denim and chitenji fabric by women in Malawi. The proceeds helped fund scholarships enabling the most talented girls in Malawi to attend medical school.

Of interest is the *Brown makes a difference*⁹ initiative of Brown University, which offers several collections of products created through partnerships with social cooperatives that help different vulnerable groups. These include *Think I Knit*, a project that makes and sells beanies knitted by single mothers who have difficulty finding steady work to support themselves, and *Extreme Needlepoint*, a community-based non-profit organization that employs new artisans in Puerto Rico and supports their training.

The role of design and possible future developments

Within the field of enhancing and promoting cultural sites through merchandising, the role of design is to develop useful products that are highly narrative, consistent to the context and cultural system, bearer of a clear and shareable message. An in-depth knowledge of the institution, its potential, its social commitments, and its territorial network is required to prevent these products from becoming a mere marketing strategy, detached from the actual university's values. As the case studies above show, merchandising is not just an end itself, but a means of communication justified by the institution's commitments and actions, becoming witness and narrator through its material and immaterial characteristics. Therefore, its value becomes more authentic when the choices made in terms of design and communication correspond to the message that the university wishes to communicate (for example, through a thoughtful selection of materials, production partners, environmental and social impact).

As a consequence of the analytical work based on existing collections and objects, the initial results confirm the importance of the variety of cultural and geographical context considered for the preliminary selection of case studies: in English-speaking countries and the Far East, for example, associations of students are actively involved in promoting the university and managing the merchandising processes. This participation is not influenced by the presence of design courses, as the valorisation of research in all its fields is a sufficient reference point for ad hoc products, usually realised by external partners.

7
<https://malefattevenezia.it/en/category/iuav-en/>

8
https://www.unibe.ch/university/portrait/self_image/sustainability/blue_university/carafes/index

9
<https://insite.brown-textbook.com/SiteText?id=61366>

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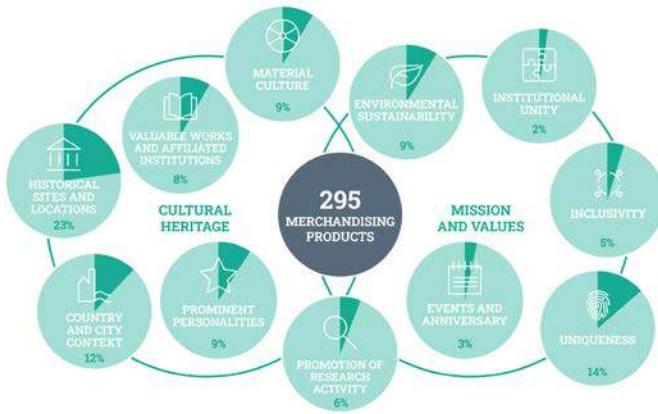


Fig. 4

Fig. 4
Quantitative distribution of merchandising products in the identified themes. Credits: Authors.

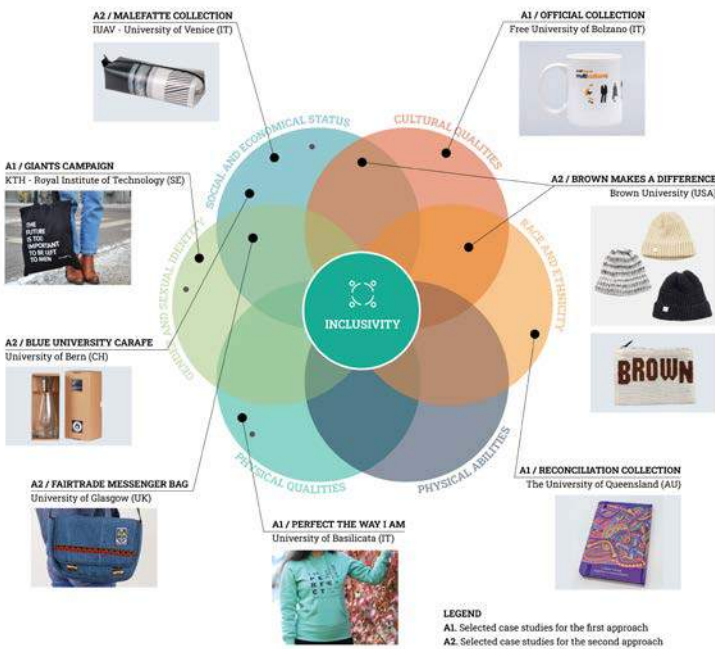


Fig. 5

Fig. 5
Mapping inclusive merchandising in worldwide universities: selected case studies. Credits: Authors.

Similarly, the initiatives described above in promoting inclusion and accessibility result from the attention that each university pays to the needs and the specificities of the population and the territory in which it is located, by demonstrating its commitment through specific initiatives.

After the development of a graphical tool useful for the case studies analysis, the next research step concerns the definition of guidelines that will result in a practical toolkit to support design of inclusive and representative merchandising products for universities, cultural institutions, and beyond. These guidelines will also aim to measure the accessibility content of the products currently distributed and sold, and will provide all the concerned parties (designers, communication and marketing executives) with an important resource for assessing any integration or redesign actions.

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Geopolitics of Fashion. Glocal Power Evidence and Design Activism for Leading Disrupting Textile Debris in Chile

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Abstract

The relocation of the textile industry has resulted in both linkages and disruptions within the regions where they have been established. Due to the creation of textile dumps, the territorial links of the textile industry in Chilean territory, specifically in Alto Hospicio, have modified the social and environmental landscape. This study investigates the relationship between global textile production networks and the environmental and social effects of textile debris entering Iquique. Furthermore, how would it be possible to make it visible and raise awareness to seek viable future solutions through *design activism* actions. The research was carried out based on field interviews, techniques of “conversation in action” (Flores, 2013) from the perspective of Grounded Theory, a research trip to the north of Chile, as well as the review of Chilean legislation, similar case studies, and literature related to the functioning of the global fashion system from a geopolitical standpoint.

Keywords

Design Activism
Fashion Industry
Textile Debris
Soft Power
Geopolitics of Fashion

Introduction to the global textile network and fashion industries.

The globalization phenomenon has led to the consolidation of the offshoring of the different stages of the production chain of many industries. The fashion industry has separated into various phases, such as the collection of raw materials (i.e., Peru with Alpaca), the manufacturing of raw materials (i.e., Italy), and the export and discarding of surplus and discarded clothing (i.e., Chile or Ghana).

From a geopolitical perspective, the delocalization of the fashion industry has formed a global network. The producing countries of the Global North not only place their new merchandise in the countries of the Global South at the expense of the detriment of local industries but also second-hand clothing as well as the product of the overproduction of their industry and the donation system of clothes that no longer has a place in advanced economies. As a result, all this waste ends up in underdeveloped countries producing textile landfills. Furthermore, by 2020, it was estimated that 18.6 million tons of clothing could end up in landfills. According to the Ellen MacArthur Foundation, if this trend continues, more than 150 million tons of clothing waste will be landfilled by 2050.

Because of industry closures brought on by the Chilean political situation, the country has not produced or manufactured textiles or clothing for 50 years. As a result, the country became a strategic hub for multinational corporations and a destination for international clothing bales, verifying Keynes' Law. The Iquique Free Trade Zone (Zofri) imports 59,000 tons of clothing (BBC,2022) per year, positioning Chile as a strategic center for second-hand and unsold clothing businesses, becoming the port of entry for these goods in Latin America. Landfills such as Alto Hospicio in Iquique illustrate the consequences of the imbalance in the distribution of the production chain within global textile production networks. This imbalance is evident in underdeveloped countries like East Africa, including the Kantamanto market in Ghana, Kenya and landfills in Tanzania (Cobbing, Daaji, et al. 2022).

Through *design activism*, the discipline of design plays a significant role, generating various scenarios (Fuad-Luke, 2009). In which to recognize and map the various territorial ecospheres, including social, economic, and environmental ecospheres, as well as the dynamics of the territory, which are the cause of the dynamics of production of the Fashion Industry.

This study aims to discover how the global textile production network of the fashion industry affects the Chilean territory revealing the links between the development of illegal textile dumps and its social and environmental effects. Specifically, it seeks to understand what is happening in the case of the Alto Hospicio landfill in Iquique. Researchers take these actions to clarify this circuit's functioning and raise awareness about this reality through design-based research (Cross,1999). These actions can potentially transform our perception of the fashion system and, consequently, initiate the groundwork for future change and innovation. *Design activism* techniques achieve this by promoting discussions and debates regarding the implications of textile landfill locations.

Methodological framework: Chilean case study through literature review and conversation in action

The study focused on textile waste accumulated in Alto Hospicio, in the Atacama Desert, and attempted to incorporate elements related to the configurations of global textile production networks and territorial inequalities, using a territorial, geopolitical, and environmental approach. In the Literature Review was conducted reviewed the following: current Chilean legislation (including Free Trade Agreements (FTA), customs regulations, and municipal regulations for landfills and dumps, among others. We also analyzed data provided by Chilean Customs on textile imports (Aduanas, 2023). We examined international examples of similar cases, such as the Kantamanto market in Ghana and landfills in Kenya or Tanzania (Cobbing, Daaji, et al. 2022).



Fig. 1
Analysis of evidence: Bales of clothing imported from Europe have been categorized based on their quality and are now available for sale in the Zofri of Iquique. The price range for these clothes is between 20 and 30 euros. Each bale is labeled with the specific merchandise it contains, such as Over-size Shorts. Photo taken by Bárbara Pino A.

To this end, the procedures for obtaining information included visiting the landfill and interviewing authorities, specialists, and those who lived the problem firsthand. Interviews were conducted with the following individuals: Sebastián Vergara, Municipal Councilor; Andrea León, Director of Sanitation and Ornament at the Municipality of Alto Hospicio; Jaime Soto, Planning Manager at Zofri; Manuela Medina, the landfill “Caretaker”; Angela Astudillo, from the ONG Desierto Vestido. The interviews employed a semi-structured approach, with the people interviewed describing their field experience and knowledge related to the textile landfill, summarized in the following points: the beginning of the problem, the current situation of the landfill, current regulations, sanitary, socio-cultural and economic situation of the inhabitants of the sector, opinion on the landfill contingency, those who work at the landfill.

In summary, we compiled all available information, including papers on the subject and analysis of local and international

press contents from sources such as DW, BBC, Cooperativa, which provide insights into the magnitude of the problem. Additionally, we reviewed the only lawsuit filed against the state of Chile and the local authorities, which documents environmental damage and traces the inception and evolution of the landfill over time, as well as the overall impact on the local population and ecosystem. To date, no environmental impact study has been conducted in the area, not even by the communal authorities. Situations of “conversation in action” (Flores, 2013) were activated to generate the need for change in the fashion industry through *design activism*. At last, a series of documentaries were created and published on social networks. These contents visually show the agency between actors, the origin, and the current situation of the landfills.

Discussion. The insights of double impact of garment production

According to the UN, the amount of textiles buried or burned every second is equivalent to a garbage truck (...), and garment production doubled between 2000 and 2014 (AFP,2021). Likewise, the amount of second-hand clothing in circulation has increased over the last 20 years (233%). It has emerged as an alternative trend for the centenary generation and for those who, motivated by the fight against climate change, believe they are contributing to this problem.

Alto Hospicio is one of the poorest municipalities in Chile, founded 18 years ago under the mandate of the President of the Republic, Mr. Ricardo Lagos. His government strongly emphasized the nation's economic growth and reintegration into the global community. Concerning this, he established several FTAs, such as with the Asia Pacific countries. First, the European Union signed the Political and Commercial Association Agreement in 2002, establishing the lifting of tariffs and tariff barriers of the European Common Market for 85% of the goods. Likewise, in 2003 an agreement was established with the countries of the European Free Trade Association (EFTA) (BCN, n.d.). Next 2003, Chile signed the Free Trade Agreement with the United States of America. Under these treaties, tons of second-hand clothing began to be imported into Chile, which over time, became the source for illegal dumps such as those in Alto Hospicio.



Fig. 2
Consequences in the adjusted area: The La Quebradilla Fair in Alto Hospicio serves as a location where clothing is sold at affordable prices to the community every morning. However, a significant portion of unsold items end up in illegal dumps located in the desert. Photo taken by Bárbara Pino A.

It is crucial to mention that most imported used clothing in Chile originates in the United States, Canada, and Europe. Moreover, nearly all of them enter the country through the Port of Iquique (Aduanas, 2023); the environmental department of the Municipality of Alto Hospicio estimates that more than 60% of the imported clothing is scrap or disposable, as Andrea León points out in the interview.

According to the lawsuit filed by attorney Paulin Silva Heredia in 2022 for environmental damage, Law 19,300, it is “300 hectares of mostly plastic clothing, discarded as garbage, less than 1 km away”. The only action taken by the municipality has been to burn the clothes causing “serious contamination and environmental damages,” and to bury them, generating a risk of petrification of these materials with health consequences due to the accumulation of gases, which makes them even more flammable. Silva reports that the problem began in 2012 with “the establishment of gigantic illegal dumps (...) currently generating a real environmental liability of approximately 30 thousand tons of textile waste, car tires, among others.” Regarding the beginning of the landfill, the dates reported match with the ones reported by Manuela Medina.

As reported in the press, Edgard Ortega, from the Environmental Department of Alto Hospicio, emphasizes that a significant portion of this clothing, being made of polyester, will require more than 200 years to decompose, thereby releasing “micro-plastics into the atmosphere and impacting the local fauna.” He reports annual fires “that last 2 and 10 days (...) as there is no legal provision,

the only solution is to burn it” (BBC News, 2022). Just like the fire witnessed during the research trip and as shown in the documentaries. Paulin Silva speaks of “severe and significant environmental damage(...)as well as the impact on a territory (...) the life and health of the people who live in areas adjacent to the illegal dumps and “mountains of clothes,” and thousands of people who go there... in trying to get some useful garment without realizing the dangers and risks of exposing themselves to and inhaling the toxic emissions emanating from plastic textile products exposed to high heat temperatures inherent of the Atacama desert”.

Exploring regulatory landscape in Chile

It is important to note that Chilean sanitary regulations require the implementation of sanitization measures on second-hand clothes imported into the country. As Chilean legislation mandates, these measures allow using chemicals such as formaldehyde, methyl bromide, or other similar fumigants (Decree 2389 Ministry of Health, 1995). In addition, it is relevant to say that formaldehyde emissions from these chemicals release volatile organic compounds (VOCs) that contribute to the pollution caused by synthetic garments in the desert heat.

It is essential to consider that the primary owners of Zofri are CORFO (Corporación de Fomento de Producción Ministry of Economy) (70%) and the General Treasury. From this point, the Mayor of Alto Hospicio, Patricio Ferreira, stated, “Zofri could not manage and control this, and the State has also abandoned us. We have become a sacrifice zone”. What we are asking is that the entry must be regulated or, otherwise, if access is to be allowed, we need to implement technologies (...) to recycle and transform this problem into an opportunity that can generate business, including the basic recyclers themselves”. Rubén Rosas, Manager of communications at Zofri, said that “the management of waste, in this case of textiles, corresponds precisely to the companies that operate them” (Cooperativa, 2021).

As a “free zone,” the city of Iquique allows entry of all kinds of merchandise, except for arms, ammunition, and other species (art.7, DFL 341 1977, DFL 2 2001). Regarding second-hand clothes, it allows their importation and only regulates their sanitization (Decret 2389 Ministry of Health, 1995). Neighboring countries, on the other hand, restrain or prohibit this type of import (Calvo & Williams, 2022). Specifically, Bolivia prohibits the entry of used clothing (Supreme Decree 28.761) and Peru (Law 28.514) and only allows its sale in 4 border districts.

Chile permits the import of used clothing and preferential tariffs for imports due to the FTAs signed with Europe and the United States in the first decade of the twenty-first century. Between 2003 and 2004, used clothing imports increased by 53.22%, according to the Central Bank (Sernac, 2005). Nevertheless, by Law 20,879, it is illegal to transport waste to hidden landfills. Manuela Medina, however, claimed that the textiles are delivered to the landfill by trucks at night.

Regarding the National Solid Waste Policy 2018-2030, in line with international treaties, this does not contemplate or authorize

the discarding of textiles in legal landfills so that in the face of the legal gap - there is no destination for textiles - the clothes end up being illegally deposited in the desert (Costa & Bacellar Zaneti, 2022). Likewise, Law 20.920, "Framework for Waste Management, Extended Producer Responsibility and Promotion of Recycling" (REP) (2016), sets incentives to reduce and promote waste valorization over disposal, but it does not include textile materials.

Conclusions

The global development model and the unleashing of neoliberal economies worldwide have produced inadequate textile waste management, negatively impacting the environment and people. Thanks to the different FTAs, Zofri became the gateway to the clandestine importation of second-hand clothes in border countries such as Peru and Bolivia. Local Chilean laws allow the entry of bales of clothing, transforming this territory into a strategic hub for used and unsold clothing that accumulates in the Global North.

Illegally, more than half of the second-hand clothing that arrives in the country ends up in a landfill, causing pollution to the soil and air when burned and buried. This situation arises due to the need for regulations or strategies for textile waste management. As a result, this situation has become a severe health problem and environmental contamination for this community's citizens also, creating an informal trade network and precarious work for resellers of used clothing at local fairs. This magnitude of problems evidences the need to rethink the global textile production networks and the impact of overproduction worldwide.

There is no short-term solution in sight, given that the REP Law does not consider textiles as waste in terms of public policies. Therefore, once there is a significant change in the current regulations and a textile recycling industry capable of absorbing the magnitude of the waste, the problem will continue. To begin with, it is necessary to raise awareness among the population and local and global authorities to educate, generate proactive strategies and bring about a positive change that will lead to new, more equitable economic and social models.

Design Activism and its potential

While *design activism* has traditionally been defined as a central axis that promotes social change, raising awareness on issues of interest and questioning the modes of mass production and consumption, today, other aspects are gaining relevance, such as the effect it can have on people's daily lives, a designerly way of intervening in people's lives (Markussen, 2013). According to Rancière, *design activism* is not just about politics but also an aesthetic act that can influence people's experiences by placing objects and themes in the social field of perception," it reorients perceptual space, thereby disrupting socio-culturally entrenched forms of belonging in and inhabiting the everyday world. (Markussen, 2012, p.44)

This effect on people, thanks to the use of a disruptive aesthetic, as art activism also does, causes the relationship between what they do and what they feel they have to do to open up, making this relationship susceptible to negotiation. Hence, *design activism* becomes

an essential tool to instigate changes in a system that harms the environment and adversely affects the lives of the people of Alto Hospicio, including addressing the environmental, health, and social impacts caused by illegal markets, smuggling networks, and the prevalence of precarious work.

Being the disruptive element, the key in *design activism* to provoke a paradigm shift effect, values, and meanings in the Five Capital Framework identified by Fuad-Luke, in this case, the Natural Capital (the ecosystem of the Atacama Desert in Alto Hospicio), the Social capital (health, work and social inclusion of those who informally market the clothes from the landfill), a collection of documentaries filmed directly in the landfill, specifically among the clothing, in flames, during the burning of the clothes (an illegal act), interviewing the leading actor, the “caretaker” of the dump, (also a role outside the law), which shows the precariousness, irregularity of the whole system and its work, as well as its dimension.



Fig. 3
Observation of “The Power of Ten”: A fire breaks out at the landfill where tons of unsold second-hand clothing have been abandoned in the desert. The fire burns for several days until it is extinguished by personnel from the Municipality of Alto Hospicio using water and sand from the desert itself. Photo taken by Cheng Lai Singer.



Fig. 4
Methodology of the interview: Mrs. Manuela, the caretaker of the clothing dump, is interviewed to gather information. Photo taken by Bárbara Pino A.

According to Thorpe's typology for cases or types of *design activism*, these videos would be considered an "act of communication" in the sense of "making information visual, devising rating systems, creating maps and symbols, and more. As well, given the nature of the problem, it could almost be taken as a "protest artifact" since it "deliberately confronts the reality of an unjust situation in order to raise critical reflection on the morality of the status quo" (Markussen, 2013, p.40).



Fig. 5
Researcher actively involved: The researcher visits the landfill during one of the major fires that caused significant damage. This visit allows for the preservation of evidence pertaining to the system. Photo taken by Cheng Lai Singer.

The results obtained from the three videos produced during the research trip to Alto Hospicio were disseminated on social media, resulting in more than 12,100 published reached accounts, despite the Instagram account @udpmodus having only 920 followers. Invitations emerged to form alliances to rethink and raise awareness about potential solutions.

These invitations included:

- Academician invited to be part of the Strategic Committee that will lead the development of the proposal of Textile Circular Economy of the Ministry of Environment of the Government of Chile;
- Consulted in the formulation of the "Clean Production Agreement (APL) on Circular Economy in Textiles," an initiative led by Cámara Diseña Sustentable, supported by the Sustainability and Climate Change Agency and sponsored by the Ministry of the Environment of the Chilean Government. Santiago, Chile;
- Conference "Geopolitics of Fashion. Soft Power for Mending the Present and Weaving the Future" at the Master in Architecture of the IUAV University of Venice, Venice, Italy;
- Lecture at the School of Architecture, Art and Design EAAD at the University of Minho, Guimaraes, Portugal;
- Informative talks about the environmental impact of Fast Fashion at schools Sagrados Corazones de Manquehue and Colegio Alemán de San Felipe;

- Invitation to participate in the application of the project “Knowledge 2030, Step 1: Diagnosis and Design of the Strategic Plan” National Agency for Research and Development. By Diego Portales University, Santiago, Chile;
- Speaker at Webinar Seminar “Sustainable Fashion in Latin America and the “Made in Italy” model” organized by ALLAM_Hub International Italo-Latin American Organization;
- Interviewed as an expert for the Sustainability assessment in the Fashion sector, developed by the Bioeconomy in Transition Research Group, School of Sustainability Studies and Circular Economy, Unitelma Sapienza, University of Rome;
- Get funding from the Universidad Diego Portales Innovation Hub’s “SEED research” program to create new materials from textile waste.

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As seen through all these actions, *design activism* can engage communities by opening them to change through participation. Adding the existing knowledge and designing disruptive formats to the dialogue and interactions with people to create alliances that promote discussion, open and motivate, and build a cross-cultural and inter-generational vocabulary common to the community that benefits the territory affected by bad practices of the globalized world.

For all these factors, it is necessary to continue designing actions and measuring their impact to verify the effect and the potential for change of *design activism* on the population to educate and modify behaviors, both in the institutions and in the people.

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Intersectional Design in Practice: A Critical Perspective on Sustainability for All

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Abstract

This paper presents an empirical perspective on intersectional design in practice. The research is related to caring for the environment and for all citizens, including vulnerable groups, working towards sustainability for all people at systemic level. Starting from the need for defining new educational ways to teach sustainability to all citizens from an intersectional design model we took into consideration the importance of data gathering by the school community towards devising inclusive processes and by applying methods from participatory discussions to prototype experiments. The same intersectional approach will be used to design the technology for sustainability education that should trigger green and digital transitions and the maximum societal reach by mean sustainability through design.

Keywords

Empowerment
Intersectionality
Diversity
Universal design
Education

Introduction

Already in 1987, the president of the World Commission on Environment and Development (WCED), Gro Harlem Brundtland, presented the report “Our Common Future”, in which one of the most highly regarded definitions of sustainable development reads: “Sustainable development is that development which enables the present generation to meet its own needs without compromising the ability of future generations to meet theirs.” In particular, the individuals most affected by sustainability challenges, such as climate change, are not imagined to be the future generations, but young people alive today, said Sir David Attenborough at COP26 in November 2021. Global warming is one of the century’s major risks and opportunities and the choices of 7.4 billion people will determine our fate. The latest IPCC report demonstrates that climate change is already affecting all regions of the world, with frightening warming projections (IPCC, 2021). Thus, the urgency of effectively delivering the message and fostering social and individual change is vital. Education plays a crucial role to empower young generations with knowledge, values, attitudes, and tools to deal with the climate emergency.

The averseness and readiness of people to alter personal behavioural patterns to change the negative effects of the events is quite low. An example is the general awareness on climate change and the potential for a mass bystanders effect (Pandve et al., 2011; Capstick et al., 2015; Leiserowitz et al., 2018). Still, most people carry on with their existing behaviour not feeling inspired to act or to take the situation seriously (Bandura, 2007; Latané et al., 1969). Resistance to change seems to be a very natural human response both on a personal level and collectively and “Equity, access to resources and technology, social and human capital, and access to risk-spreading mechanisms all function simultaneously as determinants of adaptive capacity and as prerequisites to sustainable development.” (Ahmad et al., 2005: 2). As the European Disability Forum (EDF) reports (Felix, 2022) climate change affects all people, but in a disproportionately large way it affects people with disabilities. At all times all members of society should be taken into consideration. People with disabilities and those at risk of exclusion are most affected when any crisis strikes, still they can’t be excluded from active action towards sustainability. Vulnerable people’s interests are often detached from social or environmental priorities of the society where they live (Mechanic and Tanner, 2014).

For example, refugees or displaced populations. Their primary goal is to find sheltered accommodation and food, and climate issues are not a priority for people at risk of social exclusion.

The fundamental nature of an effective societal response to questions of sustainable development was given as early as 2004 by the international statesman Maurice Strong (Secretary General of the 1961 UN Conference on the Human Environment in Stockholm and the 1992 UN “Earth Summit in Rio de Janeiro). He remarked that “...the main lesson I have drawn from my own experience in dealing with this complex of issues is the need for a major shift in the motivational basis of our current behaviour. People and nations are motivated not only by their immediate self-interest but by their deepest moral, ethical and spiritual values.” This goes to show how important it is to look at sustainable development from an inclusive society where no one is excluded, even for people with mental health issues,

or even for adolescents who balk at mainstream issues. The rejection and resistance to common goals have been recently experienced with the fight against COVID. This is a very good example where anti vaccine groups, who are from different social or political spectrum, reject the evidence backed by scientific evidence. Reaching the widest population with an environmental message is a tough challenge, and in Europe, with its wealth of languages and cultures, this becomes an interesting case. This is especially true in the case of marginalized or excluded people, who are difficult to be engaged and activated, and thus empowered, since they themselves are suffering discrimination and disadvantages.

Theoretical framework

The research approach against exclusion proposed in this work integrates well established methods and principles from inclusive design and the Universal Design (Universal Design, 1997) and its application to education (Burgstahler, 2007 a, b and c) as a way to foster engagement with vulnerable groups. Together with inclusion and universality, intersectionality is the concept that allows to recognize the interconnectedness of social identities and systems of oppression. In recent years, there has been a growing interest in applying intersectionality to environmental and sustainability education (ESE) to address issues of social justice and equity. In a critical literature review, researchers (Maina-Okori, Koushik, Wilson, 2017; Amorim-Maia et al., 2022) seek to understand how issues of intersectionality are addressed in ESE literature, focusing on how gender, race, and class intersect with environmental issues. The authors argue that intersectionality can be used to reimagine ESE by recognizing the ways in which social identities and systems of oppression intersect with environmental issues and climate change. Different contributions come from the Sustainable Interaction Design (SusIxD) (Blevis, 2007), originally aimed at the definition and adoption of interactive technologies for promoting more sustainable behaviours. SusIxD widened and deepened the scope towards the establishment of an experimental design-driven and human-centred discipline for motivating behavioural change (Fritsch & Brynskov, 2011). In particular, in this research we propose a SusIxD intersectional and multi-disciplinary perspective where design pedagogy, experiential and reflective technology-enhanced learning, psychology ethical decision making and empathy, inclusive design and accessibility merged as interwoven strands of a coherent path towards sustainable and smart futures (Giusti, Pollini, Casalegno, 2015; Clarke et al., 2019; Hanks et al., 2008).

It will gather data towards devising processes, platforms, and tools that may catalyse societal transitions toward *sustainability through design*, i.e., how interactive systems can be used to promote more sustainable behaviours, as well as *sustainability in design*, i.e., how sustainability can be used as a critical lens in the design of interactive technologies themselves (Mankoff et al., 2007). The overall objective is to prevent the overload of individuals, the isolation of groups and the break of community exchange, by applying the intersectional design (Crenshaw, 1998) and focusing on how human, social, and cultural factors interact with one another. This approach has been defined within the GreenSCENT EU funded project (<https://>

www.green-scent.eu) aiming to design accessible and inclusive digital learning experiences by studying complex societal, cognitive, and interactional aspects. GreenScent participatory, democratic, and equal user research wants to establish a two-way dialogue between all the roles involved in a specific interaction scenario, meaning providers and users of a technology/activity. The broader scope is to have a way of identifying emerging problems as well as a sounding board for new approaches or proposals relating to solutions.

Methodology

The research methodology applies participatory, experimental, and collective design approaches towards a multiplexed educational approach fostering competences to the interpretation of the world as made up of complex human-technology-environment assemblages. The combination of different user research activities are intended to reveal vital information that can help the GreenScent project to shape future qualitative and quantitative research to comprehensively study the population and their beliefs, attitudes and behaviours. In particular, qualitative research methods have been applied to gain insights into what motivates individuals and communities to behave a certain way and how they view the world or the community around them.

To achieve such objectives, GreenScent gathered numerous experiences on sustainability education and needs from a target group of users who presented heterogeneous socio-cultural characteristics to each other. Ultimately, user research intended to promote inclusive access to new integrated and holistic learning approaches in sustainability education also involving vulnerable communities at the risk of exclusion in all European countries.

The framework involved the end-users by adopting three different levels of interaction, which used a gradual and scalable approach on the three macro levels of social education:

- Primary schools,
- Secondary schools,
- Universities.

In this paper we report the activity carried out in two co-design workshops that were performed in co-design sessions at the Ellinogermaniki School in Athens, Greece, and at the RG Smart School, Novi Sad, Serbia. Two sessions were experimented:

Session 1: Problem Setting/ Problem Solving on Future Sustainability Education

Session 1 was proposed as a group discussion centered on the educational challenges provided by the natural, cultural and societal heritage. The discussion started involving teachers and educational managers in *problem setting*, with the definition of the problem, meaning what are the main educational challenges you face? Are these challenges related to lack of knowledge? Are they relating to context and culture? Further to problem setting the discussion went on to *problem analysis* by considering the context (When does the problem occur?), the problem (How does it become explicit?), the

root (What is the root cause of the problem?) and the emotion (How do you feel about the problem?). Finally, we proposed the problem solving by using the superpower technique: How will you solve the problem if you would have unlimited time, space, support, and powers? What are the alternatives to fix / solve the problem?

Session 2: Artifact as proof-of-concept: Interactive Prototype exploration

Session 2 has been an interactive prototype exploration for the GreenScent education proof-of-concept. Through preliminary and vertical prototypes of the immersive platform for documentaries, the GreenVerse, we had the chance to engage teachers and students in making experience of technology, testing specific functionalities and trials to apply them to problems. The goal of Session 2 was to demonstrate the most relevant functionalities and to imagine how it might solve the educational challenges through future sustainability education scenarios.

The Interactive documentaries demonstrator has been experimented in the workshop activities: using 360 video technologies, the GreenVerse platform will allow teachers and educational designers to create 360 video experiences on which students can contribute by creating content that will enrich the 360° scenarios proposed, and which will then be reusable and further enriched by other users, students, educational institutions (McDonagh & Brescia Zapata, 2023).

Results

The field investigation of intersection design yielded theoretical and empirical issues related to sustainability education; awareness, empowerment, culture, and social coexistence; and intersectional design, coming from the two workshops described above. The results are described with a focus on the risk of exclusion they bring.

Exclusion from context of interaction. From the point of view of the teachers, what they think the students need more is experienced to gain knowledge on their own, as well as something that makes them more aware of the consequences of their actions. Furthermore, the challenge is the discontinuity of the student's behaviour at school and at home. Even if the students are encouraged to practice sustainable actions at school, if this practice does not continue at home, it is quite unlikely that real behavioural change occurs. Teachers also commented that their students struggle making the jump from knowledge to real life experience and action. The values cultivated at home always come first and "win" the values cultivated at school.

Exclusion from adversity to rules and beliefs. Another factor that influences student's behaviour (or lack of sustainable behaviour) is the fact that they rebel against what they are taught and the authority figures. The teachers commented that the family's attitudes were the most important thing because if the family is invested in sustainability the child would be as well. The educational effort should happen both at school and at home, because if the students are taught a set of values at school, but they see the exact opposite behaviour from

their families, they will never adjust and adopt the new set of values.

Exclusion from different values. The teachers mentioned the importance of role models shown on TV, because they seem to significantly affect the common set of values of their society. When the students participated in local environmental projects organised by the school, such as tree planting, they enjoyed the activity, but failed to see the overall value of it. People need to feel they make some real difference, so participating in small projects makes them feel they made a small step with small impact. As some quoted: “We didn’t do much, that’s just a little bit.”

Exclusion from socio-economic status. For the superpowers exercise the teachers were talking more about economic power to award good behaviour than real superpowers, it felt important that the primary problems were solved first before relating to sustainability issues. All solutions were related to money. Also, even though they were given superpowers, they seemed pessimistic about being able to solve the problem. As they commented, most people think that they can express their opinion about a problem, they can protest it, but nothing is going to change, even though they try.

Exclusion from lack of device and technology. The GreenVerse prototype was very interesting to them, for example the history teacher said that exploring important places with interactive documentaries made by the students would change the whole experience in the class, it will make them more curious and have fun at the same time, cit. “Technology is our way to spice up the class”. They commented that a moderator would be needed so the students cannot post anything they want, to be safe.

Exclusion from context of use. The activities must be easy and suitable for the age of the primary school. The activities can be coordinated by the teachers who can teach how the system works but the games must be interactive, and not boring. The teacher can create and assign to students’ periodic challenges that they can conduct themselves during the course.

Discussion

Often when designers talk about people or users, the tendency is to assume that people fit into a neat homogeneous group, one-size-fits-all boxes that describe behaviour and experiences universally within that group. This research showed a wide variety of user experiences, due to the involvement of different groups, i.e. students, parents, teachers; their different digital preparedness and awareness of green transition; and the cultural and physical contexts of interaction. Moreover, as part of intersectional thinking, factors including culture, geography, mood, behaviour, abilities (temporary and permanent), different devices, and internet connections are circumstantial or ever-changing influences on user needs and behaviour. In particular, GreenSCENT faces unprecedented changes as those brought in the last two years, where we have been adapting our lifestyles and the ways we interact with others and with the environment through digital experiences. If one of the positive consequences of the glob-

ally applied restrictions was a 5.4% drop in CO2 emissions in 2020, this is going to be soon canceled out in the post-pandemic period by the so-called 'Pandemic Rebound'. During the first few months of the lockdown, a halt to manufacturing, traffic and travel gave us the illusion of a respite where the environment could finally 'breathe'. At the same time, all our activities have shifted to virtual worlds, where the use of the internet has become indispensable: videoconferencing, visual collaboration software and messaging apps are just some of the solutions that have brought benefits on a working and social scale, allowing us to continue to interact, albeit in new ways. In this transition towards a world increasingly dependent on technology, the solutions identified do not consider the environmental and the social impacts generated. On one hand some phenomena exacerbated their widespread use in the high digital density scenarios we are living in: we are increasing our digital hunger and the demand for increasingly satisfying and interactive experiences has come at a cost (Monteiro, 2019) one indicator is that since 2015 the average size of a website on mobile has grown by 105%. This provokes information overload, media pollution and data waste: every action on the internet, however fast, habitual, and apparently harmless, generates a small amount of CO2, emitted due to the energy needed to power devices and networks. On the other hand, the digital divide is increasingly excluding marginalized people from accessing information and sustainability culture as well as from social processes and transformation towards the green transition. The shift could be to reduce distractions and allow users to accomplish their goals by taking as few actions as possible, thereby reducing the time spent online and empowering human contact.

Conclusion

Climate change is here to stay and needs urgent action by all citizens. Some ways to change citizen actions is to impose regulations that are seconded by financial penalties. Softer and more resilient approaches are raising awareness and education. The European Commission is complementing regulations with new European wide education campaigns to secure personal and social responsibility towards an active response that will have a meaningful and long-lasting impact. How to communicate the need for a personal change and attitude through education is one of the challenges we face. The other is how to trigger the behavioural change.

This paper has described the need for defining new educational ways to teach sustainability to all citizens from an intersectional design model. Several research questions that remain unanswered are: how can we build a sustainability education approach to help develop new models for understanding complex phenomena through technology? Can we design interactive technologies aimed at fostering awareness, empowerment, culture and social coexistence? Can we make use of design research methods to better the means to make sense of the world? In line with Light's statement "What we face in pursuit of material progress can only be unmade if our goals globally turn to regeneration and care" (Light, 2022: p. 36) this research wants to achieve cultural change and mobilisation as part of the Green Deal development goals.

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Empower to Care or Care to Empower? The Theory Behind the Practice That Transforms

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Abstract

The global community has increasingly called for solutions to address the escalating social challenges exacerbated by prevailing patterns of production and consumption, as well as the inadequacy of traditional responses. As a result, there is a growth in the proposition of social innovation initiatives that seek to generate value through the transformation of social practices. The objective of this research is to propose a set of references that inspire the identification of movements to facilitate collective processes of fostering the creation of social value in the construction of initiatives in urban peripheries. This study will help to deepen the understanding of social innovation, exploring the process of initiatives and how strategic design concatenates the processes that involve relationships, co-projection, and dissemination of ideas.

Keywords

Creating Social Value
Strategic Design
Relationships
Co-projection
Dissemination

Introduction

Social initiatives, especially those that create value in vulnerable urban communities, transform lives, empower women and young people who historically have less access to social opportunities, and also contribute to reducing institutional gaps resulting from the absence or insufficiency of public policies. One of the pillars that support social innovation initiatives is collaborative relationships between actors, and their diffusion impacts the scalability of social value (Howaldt *et al.*, 2016). However, as far as is known, few studies are trying to understand and outline movements and practices involving collaboration between actors to create social value (Foroudi *et al.*, 2021). It is observed that several initiatives find it difficult to follow a consistent path of creating social value, optimizing existing assets and expanding capabilities, and fostering engagement, dialogue, collaboration, and creativity to face scenarios of uncertainty and dissemination of ideas. (Howaldt *et al.*, 2016; Silva, 2020).

Our study starts from the theoretical proposition made by Freire, Del Gaudio & Franzato (2017) of a model to organize the processes of social innovation, from the identification of opportunities to the dissemination of solutions guided by a Strategic Design approach, which points to infrastructure and seeding as strategies to organize and disseminate social innovations.

This research intends to contribute to the deepening of studies on social innovation, especially regarding the process of initiatives, as well as to the theory of Strategic Design in the perspective of creating and sustaining social value, adding the concepts that emerge from the field involving relationships, co-projection, and dissemination of ideas. This article is structured in four sections, starting with the theoretical foundation, methodological course, results, and final considerations.

Theoretical foundation

Since the 1970s, different researchers have endeavoured to comprehend social innovation through diverse definitions. It has been understood as novel ways of doing things and new social inventions (Taylor, 1970). The aspects of collective creation processes and new social practices have also been discussed (Crozier & Friedberg, 1993). Moreover, the significance of cross-sector collaboration in social innovation has been emphasised (Escobar & Gutiérrez, 2011), as well as the interactivity among the involved actors (Howaldt *et al.*, 2016). More recently, new forms of organization, framing, and knowledge have been addressed from a relational perspective (Pel *et al.*, 2020). Nonetheless, this fragmentation of approaches does not allow for a more comprehensive understanding of the social innovation process, as previously noted (Howaldt *et al.*, 2016).

On the other hand, many initiatives do not advance or have the prospect of continuity over time, being weakened by the limited ability to create bridges and alliances between different interests to enable the achievement of goals and significant changes. One of the first challenges of the initiatives is to create and strengthen bonds between actors, in an open, dialogic and respectful way, and to value

the creative force generated by differences and diversity (Freire, Del Gaudio & Franzato, 2017). There is little knowledge on how to make processes and tools viable to facilitate the mobilization and collaboration of actors to foster engagement and broad participation, as well as stimulate relational gains for all (Silva, 2020). This study proposes to reflect on the processes of creating and sustaining value based on Strategic Design with its flexible, dynamic, and constantly redefined relationships.

Strategic Design

Manzini (2008) reflects on aspects of the strategic design ecosystem that seek to perceive beyond the superficial or obvious, seeking invisible and unpredictable signs. A conversational attitude, covering several areas, with the aim of innovating and creating value. It is worth noting that, over time, the authors' understanding of strategic design echoes an awareness of its procedural nature that develops in the context of multiple ecosystem relationships involving different subjects, in a creative and collaborative way, interacting in design and organizational actions, in towards innovation, creating new meanings and knowledge.

It should be noted that strategic design is recognized for being fundamentally participatory and implying the systemic involvement of different disciplines, technologies, environments, knowledge, and experiences of the actors included in its processes (Meroni, 2008). These characteristics make it dialogic and interactive, as it relates to different areas of knowledge, and transformative, due to its ability to innovate and create value (Manzini, 2008).

Thus, it can be seen that strategic design can promote a strategic understanding of how a community works, as well as collaboration between participants in a creative and systemic way. It is noteworthy that strategy is understood as the collective process of creating meaning and value through relationships in terms of a system with beliefs, values, and actions to deal with the external environment and respond to uncertainties (Meroni, 2008).

From these reflections, noticeably strategic design has a significant contribution to understanding and improving the process of social innovation, since its processuality is connected to the creation and production of socio-technical devices with the potential to transform the societies in which are inserted, generating social value.

Social value

In view of the dominant capitalist reality, there is a fragmented and centralized perspective on the value and for whom it is intended. On the other hand, considering the challenges of a society in transformation, when reflecting on the value of each level of the ecosystem (Den Ouden, 2012), the importance of collaboration between the various actors involved is highlighted, in line with the approach of Mazzucato & Ryan-Collins (2019), as well as the challenge of designing the ecosystem itself to support innovation and value creation, in line with the reflections of Domanski, Howaldt & Kaletka (2019). Also,

Adner (2017) points out the importance that actors jointly contribute with knowledge, experience, and resources, build an understanding of existing demands/opportunities/problems, and co-create ideas that really respond to this, in order to create and sustain value to the whole ecosystem, as also mentioned by Howaldt *et al.* (2016).

The centrality of social innovation takes place in the creation of value that occurs when the collaboratively built solution is recognized and legitimized as a collective benefit (Den Ouden, 2012). Den Ouden (2012, p. 5) highlights that “[...] we need to change the behavior of as many people as possible to make an impact”. For this to happen, value is generated from social relationships, and they need to promote well-being, belonging, engagement, and reciprocity among the members of a social innovation initiative.

On the account of the above, the method developed in this research is presented below, articulating the theoretical approaches presented with the perspectives of the field that involved the “Guardians of Jardim Lapena” initiative located in the district of São Miguel, East Zone of the city of São Paulo. This group started its activities in March 2020, as a result of the worsening situation of the communities due to the COVID-19 pandemic. It started through an organization of residents to expand the support and protection network for families in the neighborhood of that region, with the strategy of the micro territory. It started with seven women, whose objective was to identify and meet different demands that appear in the daily lives of families in their neighborhood. In August/2022, it was already composed of about two hundred women and the capillarity of the group allows each Guardian to be a reference for a limited number of families that live in each perimeter.

Methodological course

This study is characterized by a qualitative approach, of an applied and exploratory nature (Flick, 2013) on the issue of creating social value, based on an initial model presented by Freire, Del Gaudio & Franzato (2017). It seeks to deepen the proposed model and produce complementary knowledge for practical applications, generating subsidies that support the proposition of movements that facilitate collective processes of construction of social initiatives in vulnerable urban areas.

Data collection was carried out through:

- Secondary search in the Google database of journalistic articles and opinions about the Guardians initiative, in addition to mapping another 31 initiatives in vulnerable territories, in the east of São Paulo, in other regions of the state, and in other states, initiated in the same period;
- Twenty-six interviews, with a semi-structured script (Yin, 2015); with women Guardians and partners about the processes involved in the initiative;
- Conversation circle (Warschauer, 1993) with eight women Guardians to validate the analyses performed;
- Workshop (Stuber, 2012) with the participation of 12 people, Guardians, and leaders from three other territories to discuss the findings and reflect on the perception of the concepts developed in their territories.

The data analysis, in addition to seeking to understand the process of creating social value, had the intention of raising the elements involved in the elements that sustain social value and generate transformation in social practices in communities. To ensure the quality of the research developed, three tests were used (Yin, 2015), as shown in Tab. 1:

TESTS	TACTICS	EVIDENCE
Construct validity	Multiple sources of evidence	Secondary search: reports and websites
		Semi-structured interviews (26): Guardian women (21); partners (5)
		Dialogue circle: validate field findings: Guardians (8)
		Workshop: debating the findings from the perspective of different territories and contexts, Guardians and leaders from other territories (12)
Internal validity	Data triangulation	Secondary research, interviews, dialogue circle and workshop
Reliability	Use of guides	Secondary research, interviews, dialogue circle and workshop

Tab. 1
Yin (2015); Research Quality Tests. The results of the study performed will be presented below.

Results

The Guardians initiative has its own characteristics that differ from other initiatives that emerged in the same period, as a result of the COVID-19 pandemic. Based on the secondary mapping carried out and the primary data from the interviews, we can qualify the Guardians Jardim Lapena initiative as social innovation, considering the elements presented in Fig. 1:

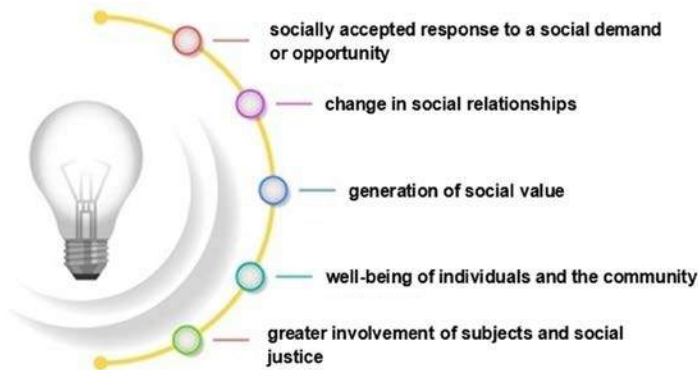


Fig. 1
Silva, M.S.; Elements of Social Innovation.

Some elements that support the initiative's social value creation emerged from the field. Here are they:

- self-management (Gonzalez & Rau, 2019) with orchestration features (Dhanaraj & Parkhe, 2006) and sociocratic principles of horizontality rather than decentralized governance (Gonzalez & Rau, 2019);
- sorority (Wolff, 2020) and empowerment of women (Silveira & Alda, 2019) who live in a situation of vulnerability through listening, dialogue, training, and, above all, the daily practice of caring for oneself and others;

- collaborative practices with a broader focus involving listening and dialogue within the group and with people in the community, in addition to the material support that other initiatives prioritized (Bjögvinsson, Ehn & Hillgren, 2012).
- purpose of strengthening community bonds through care (La Bellacasa, 2012; Tronto, 2020).

These elements have implications for the values of relationships (Biggemann & Buttle, 2012; Silva, 2020) that emerge from women's interactions over time. It stands out here:

- Personal: actors willing to help each other and share positive experiences, legitimacy, and acceptance of actions;
- Strategic: expansion of the network of relationships;
- Financial: sharing resources through networks and partnerships;
- Knowledge: generation of new ideas, increase in innovation potential; and
- Collective: characteristics of the social context, which seeks new social and new configurations of practices.

In relation to the processes entailed in value creation from the perspective of strategic design, the following aspects have been identified.

As for relationships:

- Mobilization and engagement of participants (collective value)
- Present and future of the initiative (personal and collective values)
- Organization and collective practices (personal and collective values)
- Female participation and empowerment (personal value)
- Partnerships (strategic value).

As for co-projection:

- Diversity of perspectives and knowledge (value of knowledge)
- Collaboration and partnerships (financial, knowledge, and strategic values).

Regarding the process of disseminating ideas:

- Recognition of demands (personal and collective value)
- Knowledge generation and sharing (knowledge value)
- Learning for life (personal and financial values).

The aspects identified during the interviews and validated in the dialogue circle with the Guardians were subsequently examined in a workshop that involved leaders from diverse communities. The objective was to comprehend how these concepts resonate in diverse contexts and ascertain whether a consistent process could be identified in the development of social value within the everyday practices of social innovation initiatives. Several critical movements were emphasized, deemed essential for the establishment of influential initiatives within peripheral communities, as depicted in Fig. 2:

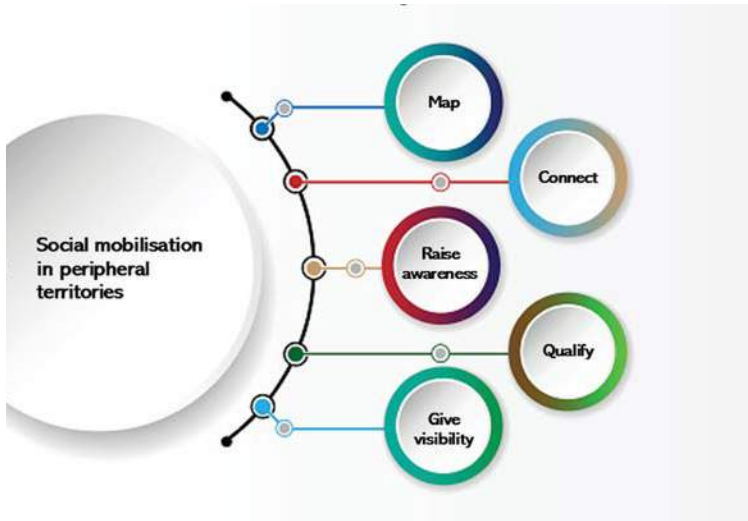


Fig. 2
Silva, M.S.; Representation of social movement movements in peripheral territories.

For each identified movement, strategies for its implementation were outlined.

- Mapping critical points: understanding the links that unite the community, through the stories of the people who daily transform the local reality;
- Connecting micro-networks and leaders: perceive and articulate the connections that already exist in the territory, regardless of their size or objective, whether affective, productive, or otherwise. These micro-networks are mobilized through assigned or spontaneous leadership. This movement makes it possible to verify the structures available in the territory, as well as how they can support the initiative. In addition, micro-networks are reliable sources for the territory's demands, generating opportunities for consistent action and generating social value, and transforming reality;
- Disseminate and raise awareness: understand the territory as a whole, involve the different actors of the ecosystem in order to integrate local powers, foster intersectionality, and enable the necessary strategies to generate the desired impact;
- Qualify the actors involved: promote spaces for development and improvement for the actors involved, involving various topics of interest to the participants, as well as preparing them for action. In view of the deep difficulties of peripheral territories and the complexity of the demands generated by social inequality, it is important that those involved in the initiative have some kind of psychological support and training to deal with the stories and pain of the people assisted by the initiative;
- Give visibility: communicate clearly, simply, and effectively how the initiative was organized, how people can join and participate, and aspects related to the transparency of actions.

The movements described above are clues to inspire the construction of social innovation initiatives that have meaning and value for peripheral communities.

Final considerations

This study is viewed as an exploratory phase within a doctoral thesis that will culminate in the development of a digital platform prototype. This platform will be built based on the findings from the field, promoting access to theoretical knowledge through questions and fostering agonistic collaborative spaces through the use of design tools and practices. Its underlying logic will be inspired by the methodology called Theory of Change (TdM) which is a mechanism to foster reflection and deeper dialogue between the actors involved in the initiatives, reflecting on the values, worldviews, and perceptions of change that make it more explicit the underlying assumptions about how and why change might happen as a result of the initiative (James, 2011).

Manzini and Menichinelli (2021) consider the platforms not only as a set of technologies, innovations, or business models, but highlight their ability to enable distributed collaborative networks that extend common discussions supported by technology in local and online activities, being a potential space to propose regenerative strategies, based on the reconstruction of the relationship between human beings and the places where they live. The authors also point out that the disruptive potential of digital technologies must be taken into account when designing platforms, not supporting activities that disrupt the social fabric of communities but supporting activities that allow communities to become hybrid. Design initiatives should aim to develop platforms that strengthen the relationship of people and communities with their places instead of focusing only on a digital dimension that is disconnected and unlinked from territories.

Thus, it is intended to build an enabling solution structured through a digital platform, in view of the possibility of registering and sharing a repository of combinations made and results obtained in different contexts; to be a space of inspiration for people and groups; and to provide opportunities for possible connections between initiatives that perhaps had no other means of exchanging knowledge.

Recognition of author roles

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Perspectives of Sound: Promoting Social Inclusion Under the Principle of “Access for All” in Museums

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Abstract

It is predictable that the employment of sound in museums is inevitable for a multitude of different reasons. The contemporary museum's emphasis on experience and participation has urged a transformation of its cultural paradigm. Multi-sensory experiences that mix auditory, visual, and tactile elements have become increasingly common in museums. Meanwhile, new demands have been placed on the museum experience as it begins to extend beyond the museum itself. It is appropriate for designers to develop a more holistic perspective on the audience's connection to the exhibits and cultural content, which should also include consideration of sound content. This research examines inclusive construction in Lombardia museums through the perspective of sound. Inclusion is the starting point that sound can be engaged with, and sound contains other potentials to explore.

Keywords

Sound
Accessibility
Sonic barriers
Inclusion
Museum

Introduction

Over the past decade, museums and society have developed into having a more intimate and cooperative relationship. The role of museums in society has expanded significantly as more and more studies have illuminated the fact that museums seek to embrace the community and the public rather than remain collection-centred (Vermeeren et al., 2018). And the growing concern on social inclusion agendas compelled museums to take a significantly broader perspective on how to serve diverse audiences (Hutchinson & Eardley, 2021). Meanwhile, today's museums are more than simply places for the collection and preservation of past or people visit, but where they gain experience and reach out to their culture and communities. Thanks to advances in technology and neuroscientific developments, it has become possible that sound can intervene in the museum experience in various ways to capture attention, create an atmosphere and convey information: as an object, as an interpretation tool, as a visitor engagement device (Hjortkjær, 2019; Wiens & de Visscher, 2019), and to enhance the overall inclusive museum experience (Brooks et al., 2019). Designers such as Studio Azzurro, Migliore&Servetto, NEO, DotDotDot, CameraNebbia, and Bottazzi broadly explored sound narratives and immersive potential as a means for accessibility. The sound acquired a crucial role in several works (e.g., *Conserve the Sound, Essen*; *Electro-Elettronica: visioni&musica*, *Biennale CIMA, Mestre*) and urban projects by Daan Roosegaarde, Emilio Stocchi, Richi Ferrero, to name but a few. This need for sound in museums is rooted in a facet that sound is an essential part of the human experience (Kannenberg, 2016). Both are a message that can convey historical rituals and knowledge and a sensorial approach to perception.

From one perspective, the field of inclusion studies has flourished as a result of the rise of social inclusion awareness. From another perspective though, little attention has been placed on the significance of sonic accessibility in social inclusion issues, as well as in the museum field (Renel, 2019). One reason for this, shown by the emerging paradigm of aural diversity is that hearing is a hidden, invisible and inconspicuous form when compared to other external features of humans (ibid.). Therefore, it is often ignored in the design process. However, the diversity of human hearing is a ubiquitous issue related to millions of people, including different degrees of hearing loss related to age, neurological problems or other conditions (ibid.). Furthermore, Renel (2019) concluded that there were two distinct sonic barriers: structural sound barrier and psycho-emotional sonic barrier. Structural sound barriers are present in museums as representatives of the interrelationship between sound and environment, such as auditory navigation, localisation and way-finding (Renel, 2019; Reeve, 2019). Psycho-emotional sonic barriers are often produced by the personal experience of internalised oppression. In some examples, a certain sound can touch a person with sadness or discomfort. It is impossible for museums to identify all these barriers considering the fact that individuals respond differently to sound varying according to their own experiences (ibid.).

It is an acknowledged fact that museums should devote increasing importance to “access for all”, including disabilities and other visitors (Schwartzman & Knowles, 2022; Leonard, 2010). Not

only is this a widespread consensus and vision of society and people in a wave of intellectual democratisation (Leandro et al., 2021), but museums are also motivated by their desire to expand their audiences to increase accessibility (Kannenberg, 2017). Usually, two aspects are involved in accessibility when it comes to museums. One is in terms of physical access, in that people can wander around museums relatively unobstructed and locate spots related to their interests without too much effort. Another means that people can access the content of museums and absorb knowledge by engaging with video, interactive stations, artefacts or any other narrative tools. (Eardley et al., 2016; Rieger et al., 2022).

It suggests that museums seek to create equal opportunities for all people to access both physical aspects and the content of museums. While there is often a beneficial intent to creating inclusive exhibits, the consequences of these special sets are not always positive. In some museums, inclusive exhibits are considered to be reserved for people with disabilities or people in need, given that disabilities can not have an identical approach to access these exhibits without inclusive interfaces. On another facet, “people not in need” are not allowed to experience inclusive exhibits prepared for people with disabilities with special content, which in a sense contradicts the principle of “access for all” (Eardley et al., 2016). Furthermore, it is considered that inclusive museum experiences are a coherent process, including the exploration of the museum environment, perception of the spatial atmosphere and the chance to hear the whispers of visitors instead of staying in a specific area with inclusive exhibits and engaging in an incomplete museum experience (Rieger et al., 2022). In this context, it is unacceptable for museums that add few inclusive exhibits to believe they can provide an equal or similar experience for all audiences. Returning back to the questions, ranging from the tendency about the social responsibility of museums via emerging sound practices in museums to new notions such as the aural diversity or sound barriers, many contemporary museums have invested in improving inclusivity at the expense of sometimes not allowing everyone access to all exhibits. While such perspectives have proven that sound/hearing is an indispensable aspect of museum inclusion and human experience, it seems that little research on the perspectives of sound adequately explore new possibilities in terms of museums toward social equality.

Methodology

The present study created an analysis and design tool referred to as “Exhibit sound score”/Partitura sonoro-allestitiva”, in particular, it took into account a framework based on a qualitative analysis by Vaz et al.(2020), ‘a framework must support integrating the different phases identified as relating to the experience of visiting cultural institutions: pre-visit, on-site visit, and post-visit’. Our team determined what constituted valuable research content and which other details to explore in different phases of the museum experience based on the literature review, and one of the researchers visited all the museums contained within the study to ensure that no meaningful content was missed. This tool aims to identify sonic barriers and analyse how sonic strategies were adopted for accessibility.

Exhibit section
Typology of the access
Contents
Exhibit artefacts
Sound equipment
Interaction
Time
Barrier
Strategy

Fig. 1
Yi Zhang, Raffaella Trocchianesi, Exhibit sound score/Partitura sonora -allestitiva.

It can also be used to design and verify new methods to empower the cultural experience through sounds. With an empirical study through the lens of the framework mentioned above, We selected these museums in the Lombardia region of Italy that belong to AM network (Abonamento Musei Network) to provide observations and comparison, analyse the current sonic barriers and position the proper sound strategies adopted by the museums. The reason we chose AM network is that the Lombardia region is endowed with a magnificent cultural heritage and AM network intends to raise awareness of this cultural heritage and enhance Lombardia territorial networks through the museum cards they provided. The cards aim to give audiences free access to museums whenever they choose within the Lombardia region. In order for exploration to be dynamic and flexible, the contents and methods of this study for the three visit phases highlighted varied concerns and were executed in appropriate forms. In the pre-visit phase, when audiences begin to form ideas about visiting the museum, they usually access information channels such as the official website and social media to find out about the museum site, exhibition theme or any other important information. Here we only investigate official information sources the museum-self provides, such as the museum’s website or app. This research concentrates on these museums with high-value gradients of sound and audiovisual content during the on-site visit phase. One of the researchers visited all these museums to locate sonic barriers,

both structural and psycho-emotional, in different visit phases that have a significant impact and to observe the effects of sound accessibility on the overall accessibility of the museum. It also aims to collate strategies for sound design and narrative that promote accessibility in museums and assess their power to reach different audiences. Semi-structured interviews were conducted with the museum managers or the staff responsible for accessibility during the on-site visit and were intended to obtain information that is inaccessible or ignored but valuable for enhancing accessibility in museums.

Result and discussion

Pre-visit phase

The museum experience begins when the initial desire to visit museums arises. Some audiences seek to obtain broad information and initial impressions of museums through different channels, also known as the pre-visit phase. In exploring and researching this phase, it is worthy of note that podcasts have proven to be an effective way to deliver the museum experience into the home to increase the accessibility of knowledge and foster audiences' interest in museums, particularly in times of social chaos such as the pandemic (Levin, 2020).

Museo Teatrale Alla Scala and *Museo Interattivo Del Cinema* offer podcasts that explain the museum from various perspectives and provoke curiosity. Audiences can discover the virtual exhibition and the Museo HUB+ digital centre that rely in large part on sound archives and vocal narratives to convey its content on the official website, with content that covers museum architecture and urban planning, the museum's history, and the theatre's past and precious collections in various times. On the one hand, *Museo Teatrale Alla Scala* has resisted confining itself solely inside the label of museum. They intend to revive the former function of this building as a cultural salon and to invite audiences into the extensive collection and sound content preserved within the museum, whether physical or digital. It aims to explore and debate music, theatre and social issues and reflect on the complex relationship between theatre, cultural identity and urban history. On the other hand, visitors can quickly build an awareness of the museum's marvels and access its authentic core spirit through the narrator's touching descriptions and original voices from days gone by.

On-site visit phase

It is appropriate to highlight a new perspective on the epistemology of museum inclusion before we discuss the sound strategies during the on-site visit phase. The museum experience is an ongoing process, and the arrival at inclusion is not dependent on creating an inclusive product in the museum (Rieger et al., 2022). Inclusive design in museums is a mission that requires taking into account all types of audiences, from the visually disabled, the physically disabled, and the learning disabled to those of different languages

and nationalities, all of which have distinct and specific demands on inclusive design. Museum accessibility is not exclusively confined to creating new inclusive settings but also includes adding new channels to existing content and exhibits so that visitors can receive them through different channels. Sound can be a medium to facilitate diverse information delivery and wider content accessibility. In this context, we seek to redefine the scope of our research. Instead of focusing on sound strategies with an exclusive emphasis on inclusivity, the study examines sound-related strategies at each touchpoint and communication channel throughout the exhibition experience and explores how these strategies can better contribute to narratives and increase accessibility.

Several exhibitions accompany the environment with open background sounds to convey meaning and emotion. In the *Museo Nazionale della Scienza e della Tecnologia Leonardo da Vinci*, before audiences even enter the 'Leonardo da Vinci Galleries' exhibition, they can hear the soundscape mixed of bird calls, animal sounds and roars, which corresponds to the theme of the area - how Leonardo da Vinci invented instruments through the observation of animals. The gears on display in another area interplay with the sound of gears clashing. Similar designs include the sounds of horses galloping and hymns of war and battle used to accompany the military structures in the exhibition. In this way, it does not narrate the specific content by dialogue. Still, audiences can easily be infected by the atmosphere in the sound and unconsciously generate associations and memories, considering that the dissemination of sound is invasive when compared to the audience actively viewing and searching for information. Memories and testimonies are some of the most prominent keywords in *Casa Milan - Museo Mondo Milan*. The museum's Golden Trophy Gallery with an immersive experience that narrates the glorious moments of AC Milan. The exhibition room falls into darkness and calm as the lights switch off at the beginning of the experience. A small circular screen situated in the centre of the ceiling showed a video about the AC Milan match, alongside the crowd's cheering, the players' screams and applause slowly. The progression of sound layers brings the audience to a crescendo as the lights twinkle in response to the changing sounds. The lights all come on at the end of the play, and it takes the audience with more excitement back to the winning moment to perceive this unique trophy room in the world. Sometimes, hearing integrates everything better than other senses in the construction of sensory worlds, and sound can metaphorically contextualise and thematise the exhibit to lead the audience to immerse themselves in the scene. One of the features of *Museo Interattivo Del Cinema* is the AR reality that audiences can scan the selected object by iPad to animate a static poster into animation with a living, vibrant soundtrack. The designer defines the various sound materials according to the development of the narrative structure through differences in pitch, timbre and type, such as dialogue, monologues, ambient sounds, special sound effects, etc. The combination of sound material provides the aural context for the story to support its narration through sound. The dynamic changes in sound facilitate the audience to catch the narrative focus from brief clips in the AR experience considering the original film can take 1-2

Other installations use sound as an entry point for interactive games, such as the installation on the first floor of the *Museo Interattivo Del Cinema*, which simulates the process of dubbing a film with four different coloured cubes that represent four different types of sound: percussion, explosion, human voice and music, and these sounds can combine to create various sound effects.

It observes that the realisation of the sound is not complicated based on a review of sonic production and combination. However, the combination of stereo, handset and headphones to form a sound system still needs to be adapted to the acoustic conditions of the space. We identified a few representative sound barriers that can be avoided by the use of proper design. The area in the *Leonardo da Vinci Galleries* exhibition is unusually high and domed, resulting in heavy sound reverberation. In the same exhibition, two videos are played in close proximity, which results in the sound sources being very close together and affecting audio clarity. Since the museum has decided not to maintain the traditional silent model, it is also necessary to confront the side effect generated from the enthusiastic response of the audience encouraged by sound, that is, noise. In the *Nutrition#FOODPEOPLE* exhibition, children gathered around the interactive table and loudly showed off their discoveries, the sound travelling through the confined room causing other audiences to scurry away to escape the screams of the children. Sometimes, sound can trigger inexplicable emotions such as sadness and anxiety (Rais, 2012), and it is suggested that the impact of sound on accessibility is far more complex than previously imagined (Beliveau, 2015).

Post-visit phase

Not all museums have made efforts in the post-visit phase, although some chose ways such as weekly newsletters or souvenirs to build connections, enhance audiences' long-term memories and to foster potential engagement and future visits. This study attempted to capture the strategies in this phase via the museum website, social media, and other approaches presented by the situation above. It is evident that the museum did not make some sound-related investments during the post-visit phase.

Conclusion

Exhibition design is a complex team task that requires a combination of geometric, material, interactive, lighting and multi-sensory elements, and the sound that interacts with these elements can create a fantastic exhibition effect. Sound design strategies evolve in a contextual and holistic manner, furthermore, designers should foster an awareness of sound sensitivity to exploit sound and increase access to sound. The museum started to break away from its original silent mode and transform into an interactive, hybrid entertainment and education centre (Baker et al., 2016). One of the inevitable consequences are new requirements to use sound in exhibitions. Nowa-

days, museums embrace sound with a more open attitude, and the forms and design language of sound tend to diversify. From the perspective of sound, obscure, historical content is transformed into a generic emotion conveyed to the audience to facilitate reflection and add a new dimension to the exhibition. Although, the scope of this study is restricted to the Milan locality and is not universal. However, this article aims to rip open a corner of sound so that its potential can be noticed by the academic and thus knowledge shared. Conversely, it encourages more disciplines to explore the issue of social inclusion through the perspective of sound.

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Track 3

Design and Responsive Technologies for Human Well-being

In the continuous aspiration of humans to improve their personal wellbeing, a design field emerges that has grown along two dimensions: one linked to the relationship between body and product that is becoming dematerialized, losing the gestural nature and the physicality, the other related to medical sciences, food, fitness activities, self-tracking system, and behavior change. In this transformative scenario, the individual becomes the center of a knowledge process that changes and transforms his/her body towards a renewed balance between design and technologies. The debate we wish to open in this track is related to a model in which human being is at the center of a system of wellbeing between interpretation and prediction.

The aspected proposals should be focused on the role of responsive technologies, capable to adapt to a single person, and the importance of personal data and its applications that pose new challenges for the design processes and the evolution of these human-centred-technologies to improve our body awareness and potential.

The track opens horizons for new meanings and focus points on design studies and practices which include researches focused on products and services in which the wellbeing of the individuals and the collectivities are the center of a human-center approach to the innovative use of the technologies.

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Abstract

The field of research involving design and well-being, finds in the development of responsive technologies and Artificial Intelligence the latest tools for mutual influence and transformation.

Research on this topic, shared at the *Disrupting Geographies in the Design World* forum, testified to the multiple and contemporary fields of investigation related both to technological development and the human sphere.

The paper proposes a clustering of research on this topic into two sets: the first group gathers research and design approaches that increase human knowledge toward digital data, the second brings together insights on behavioral changes generated by design using emerging technologies.

The results of the debate and the categorizations open new focus points aimed at improving, through the discipline of design, individual and collective well-being.

Keywords

Well-being
Health
Self-tracking
Human Body Design
Data

Introduction

Well-being and responsive technologies are an important contemporary design field combining the latest advancements in technology with wellness practices. In the continuous aspiration of humans to improve their personal well-being, a design field emerges that has grown along several dimensions: linked to the relationship between body and product –more and more dematerialized, losing the gestural nature and the physicality– related to medical sciences, food, fitness activities, self-tracking system, and linked to behavior change. In this transformative scenario, the individual becomes the center of a knowledge process that changes and transforms his/her body towards a renewed balance between design and technology. The debate we wish to open in this contribution is related to the research of models in which the human being is part of a system of well-being between interpretation and prediction and how the human body is involved and changes his behaviors.

Designers could play a critical role in the development of these innovative artifacts, and they are responsible for designing the tangible forms, the interfaces, and the user experience of this new class of products, ensuring that they are helpful, respond to the real needs, and intuitive for the user. They work in multidisciplinary teams with developers, researchers, and other team members to create a useful and engaging experience for the people.

These design approaches to technologies can help to create products and services that provide people with new tools to monitor and improve their physical and mental health that can be customized to fit the unique needs of each person. Some examples of responsive technologies include wearables that track fitness and sleep patterns, virtual reality therapy, and AI-powered mental health apps. As the field of wellness and responsive technologies continues to grow, it has the potential to revolutionize the way we approach healthcare and well-being.

The development of emotion analysis technologies such as computer vision, and natural language processing, has facilitated the adoption of these techniques beyond monitoring or diagnostic, moving towards interventions to facilitate well-being. AI-augmented applications such as avatars, and bots are indeed used for digital therapeutics by accessing peoples' emotions, to cure and prevent medical disorders (Hamada & Kanai, 2022). Recent advancements in machine learning have enabled hyper-realistic animation of faces and the cloning of voices from fictional to non-fictional characters. Beyond the malicious use like for example Deepfakes, researchers highlight how these technologies offer new opportunities for creating interactions with digital characters that can deeply engage us: AI agents may be able to provide support through voice-based conversations and facial expressions with the potential to enable deeper personalization and increased trust on the interaction (Pataranutaporn et al., 2021). Another important step is constituted by the set of *embodied AI*, or artificial agents able to learn through interactions with their surrounding environments (Duan et al., 2022). This is about giving for example social robots another dimension for unscripted interactions perceiving them as independent agents with their own motivations and desires. For example, Robin, the social robot for

diabetic children, behaves in a way where sometimes it disengages from interaction with the children to look for other things or initiate other activities. This characteristic, including *having* diabetes, and its capacity to provide personalized experiences, makes it a *life-like* character meaningful to diabetic children (Cañamero & Lewis, 2016). The embedded capability of these systems to make decisions fueled by data and independently from human assistance, makes them face ethical challenges related to data governance, consent, ownership, and privacy. AIs are in a way influencing forces that can shape our choices and actions, but they could also foster positive social interaction and cooperation, key elements to human well-being. This opens a broad challenge for engineers, designers, and policymakers in shaping our socio-technical system. Human existence is embedded in a network of physical, biological, and social relationships. AI tools are becoming an important part of this ecosystem and they have the potential to reconnect us on an individual and community level, considering all the multidimensional values involved.

Knowledge and behavior as a cluster of trends for human well-being

In the field of research on responsive technologies, a technological level of digital systems is emerging that increasingly enables the reading of human complexity and offers possibilities for providing dynamic responses to the singularity of people.

The studies shared during the Forum bear significant witness to the multiple and contemporary exploration fields investigated by design. These can be clustered into two sets: the first groups research and design approaches that augment human knowledge toward digital data; the second brings together insights into the behavior generated by designs using emerging technologies.

Knowledge

The focus of this group of research is the dialogue between the human body and digital data related to a place or to an entity. These data contribute to characterizing the spaces from which they come (Zannoni, 2018) or the objects that are expressing them. The translocation of these data into elements that can be experienced in the human perceptual field is an area of research and design characterized by high complexity. Tools capable of augmenting the reach of sensory channels have been described by Tomás Maldonado (Maldonado, 1997) as sensory-perceptual prostheses, and their presence in research and the market is evidenced by numerous case studies. The application areas of these projects are mainly health, professional and amateur sports, and wellness related to lifestyles.

The body aimed at self-knowledge

Projects and research that use human physiological and behavioral data with the goal of acting on the person from whom they are derived, are inscribed in the research field of *quantified self* (Swan, 2013). This topic is widely established in the marketplace as evidenced by the widespread tracking systems of physiological parameters in the field of sports and health (Zannoni et al., 2022). Despite the stable presence of the research strand, there are many innovative directions in which researchers are working in recent years.

An interesting reflection on this issue is proposed by Antonella Valeria Penati and Carlo Emilio Standoli. The research highlights how difficult it is to measure the results of design interventions. This is especially so when a prolonged temporality enters the experiences with the consequent effects on perception and human dynamics. With respect to these analyses, the discipline of design is identified as an inclusive and collaborative tool for generating an ethical breakthrough.

This turn seems to be glimpsed within the research presented by Giuseppe Mincoelli, Gian Andrea Giacobone, and Michele Marchi. The paper shows the results achieved by the PLEINAIR project in which the data collected were used in order to raise awareness of behaviors aimed at improving well-being and mitigating the impact of aging on the quality of life.

The body aimed at the knowledge of others

Physiological and behavioral data used to give answers outside the individual from which they were extracted is a frontier area for both design and other scientific disciplines. Here technology aims to recognize behavioral categories from the data itself; an example is the research field of *affective computing* (Karyotis et al., 2017) in which face-tracking software recognizes emotions.

These data can also be translated into object behaviors that become mediators between people. The importance of such research is growing as robots become more ubiquitous in everyday life. Within this field is the research presented by Lorenza Abbate and Claudio Germak. The two authors investigate how design can express itself within the empathic implementation processes of telepresence robots through communication processes –bodily, gestural, and vocal– in relation to social contexts.

Designing in this field requires multidisciplinary skills and many different stakeholders. Design has a duty to enter these processes and understand the mechanisms through which to dialogue with other disciplines. With this goal, researchers Christiam Mendoza, Roberto Íñiguez Flores, and Ruth León Morán measured themselves against the role of design and specifically the creative process in synergy with engineering disciplines.

The area of research aimed at transforming environmental data into elements related to the field of perception is broad (Gellersen et al., 1999). Significant representations of this field are embodied both by designs that intervene in close connection with the perception of individuals and by those that translate data into characterizations of collective spaces. In the first category belong, for example, the experiments by cyborg artists Neil Harbisson and Moon Ribas¹, both of whom are engaged in transforming a datum of the environment into a sensation experienced by their own bodies. In the second category, we find projects pertaining to the fields of digital placemaking, digital wayfinding, or digital sensemaking (Dall'Osso et al., 2022). Here, sensors diffused in space through citizen action (De Greve et al., 2022) collect information that can be translated into sensations that can be experienced through space.

The analysis presented by Elena Cavallin compares data-driven designs that act close to the human body with those more distant from it. It emerges from the literature and case studies review that the impact on well-being is more measurable when acting in proximity to the user than in designs more distant in time and space.

The complexity that emerges in these processes calls designers and researchers to question about ways of designing. With such a need, Margherita Ascari, Andrea Cattabriga, Simona Colitti, and Ami Liçaj focus the attention of their research on ways of representing design processes highlighting the need to imagine new nonlinear models.

Closely associated with the evolution of design practices is the need to develop tools for accountability to complex systems. Around this need is the analytical work proposed by Jane Vita, Tiina Mäkelä, and Teemu Leinonen. The researchers show how technological innovations, when managed with systemic and participatory action, can support an understanding of human rights, regulations, the environment, and biodiversity.

A significant contribution to the project is the expressive possibilities derived from materials research. Innovations in this field have great potential as Noemi Emidi's work demonstrates. Innovative configurations derived from interactive, dynamic, and bio-inspired materials design open up renewed experiences of comfort and meaning related to environments.

Behaviour

The field of designing objects, systems, and services to affect the body, mind, and more specifically human behavior, has grown exponentially since the 1980s, following the spread and subsequent increase in the use of technological tools. Starting from Donald Norman's early thought on the psychology of everyday objects (Norman, 1988), through *captology* (Computers as persuasive technology) (Fogg, 2002), to the more recent teachings on *Nudges* (Thaler & Sunstein, 2021), the theories and techniques used to design changes in behavior through technological tools are numerous and frequently adopted in a variety of fields, for example, the medical one or those related to mental and physical well-being.

This research converge fields of knowledge related to embodiment theories, the phenomenology of perception (Merleau-Ponty, 1945), and neuroscience.

The spaces in which the human body moves and interacts are tangible, virtual, or mixed. The research collected in this cluster, highlights multiple ways in which digital technology intervenes by demanding behavioral responses.

The triggered body

The body reacts continuously to external stimuli, and its reactions are determined in most cases by psycho-physical triggers (Safer, 2013) which affect the individual's sphere of interest. In this case, the body is temporarily activated, and attention is captured *here and now* by triggering cognitive, perceptual, and emotional channels.

Activate is a verb that is often used in the field of design for the enhancement of cultural heritage, and it is meant to emphasize the design activity aimed at making Heritage more usable and accessible (Lupo, 2021). Also called *activating objects* in this context are those artifacts that, upon the user's gesture, trigger audio-visual content.

The contributions offered in the Forum confirm that one of the application areas of research in which digital technologies are used to activate body reactions is precisely the museum field. Alessandra Miano's work clearly expresses how much this kind of design can strengthen visitor experiences of fruition and engagement. Museum spaces, densified with multisensory actions, activate reciprocal relationships between users and artifacts, strengthening narrative and cognitive action.

Enhancing cultural heritage through augmented digital experiences is also the focus of Letizia Bollini and Marco Borsotti's reflections. The researchers explore the evolution of exhibition languages and practices and, through a Design-Driven Innovation perspective, investigate multiple design directions in which the human is at the center of a communicative ecosystem. In this perspective, the multiple nature of space can respond to the narrative components of exhibits while preserving a balance between body and technology.

Another area in which the body is activated by external agents and stimuli is food. Lígia Afreixo and Francisco Providência propose research with an ethnographic point of view that examines how different ingredients and cooking methods give rise to multiple constructive, organoleptic, and functional characteristics. The reasoning considers different cultures and extends to new technologies through which results comparable to industrial processes can be achieved.

The conditioned body

Conditioning is often conveyed by physical stimuli related to the perceptual, emotional, and psychological spheres, but only when the action is repeated does the behavior change take on the characteristics of habit.

Examples of objects that condition the body include smart water bottles-such as the Hhydrate Spark², which reminds the user to drink through visual and haptic feedback, the smart object Doppel³, designed and developed by Fotini Markopoulou, Jack Hooper, Andreas Bilicki, and Nell Bennett, a wearable device worn on the wrist that through vibration reduces stress and increases the user's attention or Ellie⁴ the pills organizer that reminds the user of pills to take in a relatively long time frame.

2
hydratespark.com

3
feeldoppel.com

4
elliegrid.com

Also fitting within the area of psychophysical well-being and medical prevention is PASSO Project by Silvia Imbesi and Giuseppe Mincolelli. The project aims to develop an innovative biofeedback system specifically designed to monitor and rehabilitate gait and postural impairments in people affected by Parkinson's Disease, during specific training sessions in domestic and ambulatory environments.

Also Pathos by Elisa L'Angiocola and Angela Giambattista is a project aimed at the well-being of patients in the hospital setting and proposes a service to enhance a good hospitalization experience aimed particularly at women treated in the gynaecological-obstetric department. The system involves monitoring patients' emotions through a device, thereby changing, in this way, the behaviors and type of communication of nursing and medical staff in relation to changing moods.

Finally, Francesca Bonetti and Giorgio Casoni propose an interesting research project that aims to enhance the cognitive abilities and performance of people in the workplace through the neurotechnology used in the Brain Wellness program. In the latter case wearable biofeedback sensors as well as different training sessions, lead users to modify their behavior by reducing stress and anxiety, and increasing determining components such as focused and sustained attention, awareness, resilience, and mental presence.

The communicative body

Awareness, consciousness-raising, and consequent behavior modification also pass through the communicative sphere. The representation of data or the immediate visualization of complex information can be one of the vectors that enable the processing of thoughts and opinions. This system, acting not just at the sensory level, but also at the cognitive one, leads to greater awareness of the body in relation to the surrounding world.

There are numerous examples of such an approach, among them are the representative infographics of the daily movement of wearable devices, or the data visualizations of numerous newspapers related to the Covid-19 pandemic period.

The research of Elisabetta Cianfanelli, Margherita Tufarelli, and Elena Pucci, leak the relationship between the human body, clothing, and the surrounding world. Through a framework built by examining case studies, the researchers propose an interpretation of the most recent transformations in the fashion industry. They thus make it clear that clothing can be an important tool for making the wearer, but also those around him, aware of certain external or internal stimuli. These wrappings, for example, auto-actively transform, register feedback, or augment certain human functions.

Daniela Anna Calabi and Alice Maturo consider the apo-mediation approach as fundamental to communication and awareness processes in the field of health. In particular, responsive technologies in the health communication field stimulates solutions for accessible prevention information, thus increasing awareness, by interpreting the needs of different stakeholders-physicians, patients, and citizens. Such a communication system translates the complexity of information and makes it understandable and communicable. In this case, body awareness and consciousness-raising passes through the lens of design, which acts as a mediator and translator of data and content.

Conclusions

Within the field of well-being and responsive technologies, promising scenarios and trends emerged for future developments in body-related design.

The contributions shared during the Forum brought out two main clusters that respectively gather three research trends. The first cluster groups research investigating the relationship between specific categories of data and knowledge. The second brings together research that investigates the ways through which to provoke behavior change in individuals. In particular, the following specifics are highlighted:

CLUSTER 1 – KNOWLEDGE

The body aimed at self-knowledge, an established field developed in the scientific literature, uses physiological and behavioral data of the individual by processing and translating them for self-understanding.

The body aimed at the knowledge of others uses physiological and behavioral data of individuals' bodies that are processed and translated to inform other people. This recent field is at the center of a phase of technological consolidation and is being debated and deepened with regard to its applications.

The body aimed at knowledge of its environment contemplates heterogeneous data afferent to space that are processed and translated to become part of the experience of one or more people. It turns out to be an emerging trend that is still under-researched. The many stakeholders involved make it complex and difficult to manage; despite this, this area could potentially be accessible and implementable in the future with the development of technologies, such as AI.

The triggered body which reacts in a specific time and space to a distinctly perceptible action, is within a contemporary research area that follows the evolution of technologies.

The conditioned body which reacts to a periodic or continuous action by changing the behavioral pattern of the individual is well represented by research and commercial products and appears to be one of the most promising trends for the coming years.

The communicative body among the most established trends in the design research landscape, increases people's awareness as a result of understanding information and works on the multiple forms of communication and simplification of complexity.

The result of this debate opens horizons for new meanings and focus points on design studies and practices which include research focused on products and services in which the well-being of the individuals and the collectivities are essential elements of a human-center approach to the innovative use of the technologies.

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Are You Me? Re-Embodiment Process for Telepresence Robots

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Abstract

Accessibility in distance education activities represents a challenge that needs to be addressed with a view to social inclusion and collaboration between the stakeholders of the school system. Also, as a resilient response to the Covid-19 pandemic, today we are witnessing research and experimentation on the theme of connecting people at a distance through solutions and tools designed to facilitate the teaching/learning process and socialisation, to make the impact more human with advanced digital technologies for image transfer.

In this direction, telepresence robotics demonstrates a discrete potential regarding pedagogical effectiveness and social inclusion. Still, it also needs to investigate in greater detail the requirements for acceptance and service management.

This contribution presents the results of a workshop/laboratory with university students at the Politecnico di Torino to investigate the first requirements related to the physical and cognitive embodiment of the telepresence robot through an interdisciplinary co-designing experience.

Keywords

Social robot

Telepresence robot

Human-robot interaction

Robot embodiment design

Introduction

The development of research and experimentation in social robotics has led the discipline of Human-Robot Interaction to question the acceptability of and trust in such machines from a semantic and functional perspective (Jost et al., 2020). The aim is to design increasingly high-performance scenarios for a machine that can appropriately perform specific tasks about the user and context of the application. In the interaction between the person and the robot, embodiment, i.e., the combination of the physical body, gestures, and speech, plays a key role in the robot's interface with the outside world, primarily with and between people (Falcone, 2020). Therefore, the embodiment is regarded as a transitional element between the virtual algorithm underlying the machine's operation and the natural communication of forms and expressions. It is the result of a complex mediation between functions, meanings and expressions that have been studied for years by interdisciplinary expertise: the hard (mechatronic and computer engineering), the soft (cognitive psychology and neuroscience) and the design (design). Design makes available to this research its holistic and problematic approach to design and its methodologies of experimentation in co-design with users. These concern the evaluation of the formal/expressive solutions of the machine and the languages for interaction and the final evaluation of the user experience (Ostrowski et al., 2020).

In the relationship of trust between the person and the machine, the possible characterisation of the embodiment and interaction plays a key role, which can take place by user groups or even as customisation on a single user (Pinney et al., 2022).

User satisfaction depends, in some cases, e.g., for children and adolescents, on the physical adaptability of the machine. At the same time, the interaction's easy, familiar, and social (even fun) accessibility remains a universal goal. This affects the robot's ability to respond quickly and articulately through movements, gestures, lighting, and sound feedback.

Today, however, there are still no telepresence robots that can be characterised in the body: the desire for embodiment customisation clashes with the difficulty of building machines with high adaptability. Indeed, research into machine characterisation places severe engineering constraints on physical transformation in terms of transportable weight, speed of movement and battery autonomy. However, this remains one of the most ambitious goals. In contrast, the different configuration of digital interfaces, a performance already integrated into some series and prototype models, allows incremental adaptations of the robot's levels of expressiveness and communication. This paper aims to develop a co-design methodology for implementing the social and expressive empathy inherent in the interaction with a telepresence robot to be included in the university context, but also to facilitate the life of the remote student by improving his learning and sociability. This objective was the starting point for an initial robotics interaction workshop in which design students, assisted by psychologist mediators and mechatronic engineers established an experimental relationship with the machine, playing the alternating roles of interaction designer and evaluator and user.

Background

Telepresence robots are tools that allow subjects unable to be physically present to be remotely connected not only with audio and video but also through a body capable of moving in space and following activities behaving as an avatar of the distant subject (Kristoffersson et al., 2013). However, such applications still show many limitations precisely because the tool cannot contextualise and characterise itself concerning the context of use and the different types and ages of users (Tsui et al., 2015).

There is still room for research into a robotic machine whose profile of the subject can characterise physical and digital interface at a distance, and which can interact more with the person or group in the physical presence (Fitter et al., 2021). This refers to a complex machine in which the body (head, torso and limbs) and sensory communication (looks, gestures and voice) make the interaction more accessible and identifiable.

The study of cognitive and physical embodiment as a mediator of communication between people at a distance involves exploring activities that occur in two distant but interacting contexts (Nosengo, 2013). Telepresence is an eco-system in which users, environments and devices located in distinct places and with different levels of interaction take part.

Remotely, the user guides the robot through 'input' devices such as a computer, tablet/smartphone and headset. The robot here acts as a subordinate, executing commands in space and interacting with users in their presence. Nevertheless, here its role changes, establishing a communication relationship based on the interaction between 'outputs' consisting of the physical body, audio, video, sound, and light (Björnfot, 2021).

Considering the current limited performance of telepresence robots, in the first case (piloting), it is the digital interface that is the main object of design activities, as it provides the user with situational awareness and awareness of the space in which the robot moves (map-based or video-based control). The freedom of interaction is limited to movement alone, without the possibility of the user having other elements to represent himself, his emotions and gestures. However, even in the second case, i.e., the environment in which the robot and the user(s) are present, apart from audio-video communication, today, these subjects have no other possibilities of interaction with the machine.

These differences in roles and interactions depend very much on the 'context' and the 'type of user'.

Let us think about the physical appearance, i.e., the robot's body. Telepresence in the context of elderly care, e.g., compared to the school context, describes different uses and roles of both the robot and the users. The older adult does not drive the robot remotely but receives assistance and comfort via a screen integrated into the machine. Different people such as family members, friends and doctors take turns appearing with their faces or figures on the screen of a robot whose body does not represent them, not least because it would be challenging to change identity abruptly with the technologies we have today. Whereas in the case of the distance learner, as the robot's body physically complements a single person's

face at a distance, this could take on a more specific physical and sensory communication identity (Isabet et al., 2021).

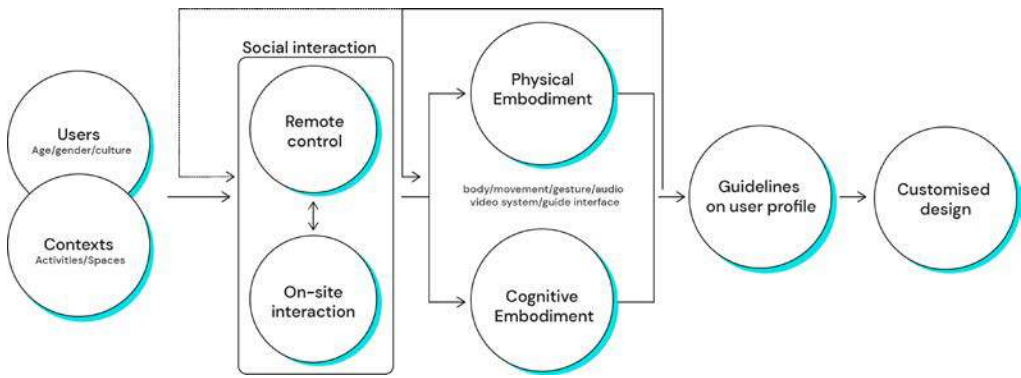
For the older adult, the robot's physicality and embodiment are still essential, but they carry other meanings. For example, the older adult asks the robot for a reassuring identity and comfortable gestures through physical contact and voice, combined with an attentive and quick presence in performing commands. In contrast, in the case of the remote student, being part of the group is the absolute satisfaction associated with effective tele-movement performance in space and interaction.

Again, we have different roles of the machine in relation to the context and the different types of users. In the case of the school environment, they are considering the different age groups of the student (primary school, secondary school, university), and the emotional manifestations and behaviours of the user(s) change. In other words, different empathy relationships with the machine are triggered by a mixture of biological and cultural factors; consequently, the performance required to ensure a comfortable and engaging experience varies (Casoni & Celaschi, 2020).

Therefore, designing socially and culturally effective interfaces still presents many questions and difficulties, mainly due to many context and user-type alternatives that may vary according to factors such as age, gender, culture, and digital abilities. Moreover, to which are added the personal behaviours and reactions of the person determined by the degree of trust, acceptance, and familiarity in interacting with a robot.

These design problems, which are difficult to approach, are today referred to in the robotics interaction literature as 'wicked problems, which are influenced by multiple factors and are therefore indeterminate: this means that there are no established solutions to them, whereas there may be more than one appropriate solution for each problem (Luria et al., 2021). Precisely because these are problems of an unstructured nature, the contribution of empirical and experimental research is crucial for defining guidelines to support design.

We are witnessing, on the part of various research institutes located in various parts of the world (around 40 of those mapped by the UXDPoliTO research group), a proliferation of solutions in which telepresence robotics is introduced into education in spot experiments linked only to the pedagogical effectiveness of the tool and ease of use. This brings to light the lack of research in terms of possible characterisations and customisations of the robotic machine consistent with the 'context' and the 'type of user' carrying out different activities: what well represents a future of development of social service robotics marked by the enrichment of performance in terms of technological humanisation and flexibility of use [fig. 01].



Co-Design Robotics Workshop

Increasing the effectiveness of social robots as mediators between people has become an urgent goal for both research and the market. The importance that grows exponentially with the spread of robots in many areas of daily life is directly linked to confidence in the usefulness of these new technologies. Among the main obstacles are the problematic, indeed cumbersome, operation of the robot, which does not allow an intuitive guide like what happens with other devices, and the slowness of the offer, especially of the machines that are now on the market, of incremental performances in terms of customization and ease of management and maintenance, as well as a still elite cost. A work aimed at increasing the acceptance of the machine by improving performance both from the social and managerial level, allowing the remote student to improve their academic performance and social life. By decreasing the load of actions that the individual has to carry out remotely, he will be able to concentrate more on educational activities and on life with his classmates, supported by their actions.

Motivations that direct robotic research, also through the contribution of design, to involve users in the design process right from the start (Bartneck & Forlizzi, 2004). As far as design-driven methodologies are concerned, there are at least three moments in which the evaluation of the process with users is essential: in the initial collection of considerations on the usefulness and relevance of telepresence robotics in facilitating and improving relationships between people (brainstorming); in the multi-criteria comparative evaluation of the accessibility and orientation performance of some models of serial production of robotic machines (benchmarking); in evaluating usability concepts and improving embodiment (prototyping).

The simulation of these three phases was the subject of the 'RoboPoli' workshop conducted in co-design between graduate students in Systems and tutors of the three disciplines (cognitive psychology, mechatronic engineering and design). The objective of the experimentation was the possible characterization of a telepresence robot in the university environment, starting from the analysis of the market trend and from the experimentation of a serial robot model accredited by our previous research. In the field

Fig. 1
Design process for characterising social telepresence robots for a given context/user. Credits: authors.

of HCD, there are several research approaches used by researchers and practitioners in HRI projects: participatory design, ethnography, lead user approach, contextual design, co-design, and empathic design (Steen, 2011).

Co-design and participatory design are two of the methods in HRI that serve to address evil problems by placing stakeholders at the center of the design space while creating implementations or new technologies (Ostrowski et al., 2020). This approach to design allows for the identification of opportunities for technologies and the framing and reformulation of the problem space, creating artifacts as the iterative process of development, invention, evaluation of relevance and effectiveness unfolds.

In this context, it has been shown how participatory methods facilitate, on the one hand, the development of existing robotic applications and platforms and, on the other hand, the emergence of new common platforms and a greater sensitivity towards a greater contextualization of these machines (Björling et al., 2020).

HRH exploration by design

The workshop's main objective was to understand how the telepresence robot can better interpret the role of mediator between people in the concept of HRH human-robot-human. This fundamental characteristic distinguishes this category of machines. This was followed by experimenting with embodiment upgrade solutions to ensure that the robot's appearance and communication are consistent with the cognitive and interactive capabilities of the people using it and that the machine knows how to interpret the tasks to be performed in the context in which it operates (university environment).

Therefore, the co-design process within the workshop was based on participatory and human-centred design through steps of increasing inclusive level [Tab. 1](#).

The objective of the first exploration phase (scenario) was the description of interactions with distant subjects using telepresence robots. Limits and opportunities in using the machine by in-presence and distant students and teachers were collected as observation feedback. The areas of investigation were used as a basis for structuring the explorations within the co-design process.

The robot used to evaluate the implementations was the Double Robot model, an archetypal and synthesising product of all formal and functional characteristics found in telepresence robots.

The second phase of the work (concept) was concerned with implementations or adaptations of the chosen machine in favour of the university environment and spaces, evaluating its limitations and opportunities.

The students focused on specific activities, such as working in groups, sharing recreational moments in the spaces, and implementing and humanising the machine's communication system. The choice of group work derives from the fact that the students involved, within their university activities, carry out most of their work in groups and for this reason they have identified this activity as fundamental to consider.

In the third phase (prototyping), the workshop developed re-embodiment concepts (Reig et al., 2019) of the chosen machine model and their evaluation. Re-embodiment refers to the contribution of artificial intelligence to characterising the person at a distance through the robot's body and gestures. Different levels of personalisation were experimented with in the course of the work, evaluating the social and interactive involvement in relation to the activities that characterise the university day. Several times the question "how could telepresence robots be turned into social robots for the university?" was posed to understand better the factors contributing to a greater social acceptance of telepresence robots in the school environment by putting the students themselves in the driving seat and receiving the reactions.

In designing the implementation of the machine, a design process with divergent and convergent phases was adopted, balancing concrete and abstract thinking. In the context of conceptual design, divergent phases allow more ideas and concepts to be generated, while convergent phases allow ideas and concepts to be narrowed down. The divergent and convergent activities within the co-design process were used to explore "open themes in an unconstrained manner" and subsequently "focus on more specific design objectives".

AREA	DESCRIPTION
Appearance	Evaluation of the general appearance of the physical interface of telepresence robots
Context of use	Assessment of the suitability of the robotics service for the potential application context
Interaction	Assessment of the level of interaction from both locations and potential future development scenarios

Tab. I
Investigation areas
of the workshop.

Factors shaping HRH

In the initial stages of observing and evaluating the machine with the students, limitations and requirements were identified to implement the robot. During the brainstorming, the students questioned themselves on three topical moments of university life: classroom lectures, laboratory activities and library activities. In each of these moments, the point of view of the different actors involved in the telepresence ecosystem was used: peers at home, students in the presence and lecturers. In each of these specific situations, critical points in the interaction with the robots were identified through the construction of user journey maps. These included the lack of language and social interactions to improve communication Fig. 2.

The students then began to reflect on how they could perform daily tasks within the university, leading them to formulate two low-fidelity concepts and prototypes to implement telepresence robots: the first "Attracting attention without attracting attention" and the second "Immediate human interaction". The design of these scenarios helped to get the complete picture and plan the most appropriate interaction modes.

Each of the two prototypes underwent evaluation procedures. First, the designers tested their low-fidelity prototypes through the Wizard of Oz technique, when the robot is controlled or animated

remotely but behaves as if it were autonomous. A quick and agile procedure to understand how implementations improved the relationship with the machine.

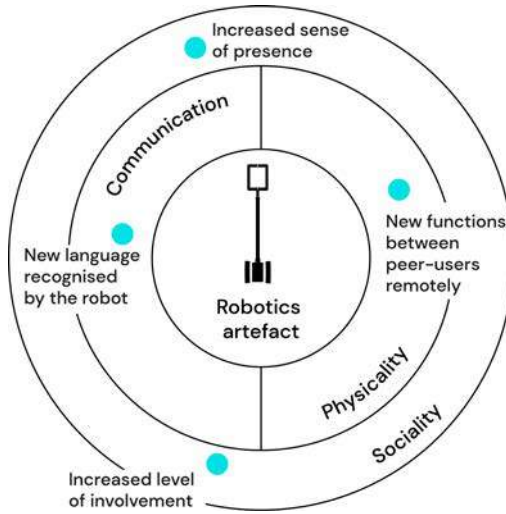


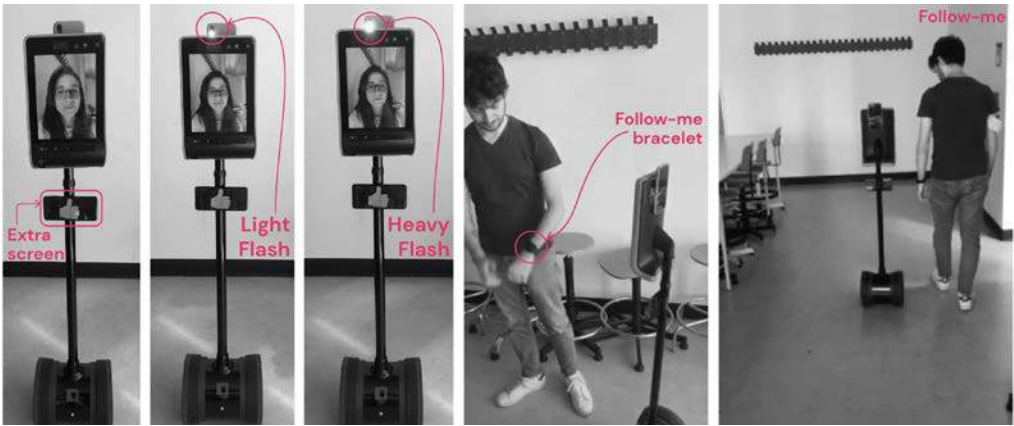
Fig. 2
Design intervention opportunities to implement telepresence robots. Credits:authors.

Attracting attention without attracting attention

The first concept sought to increase the identity and self-presence of the person within the school environment, through humanised machine feedback, without making them invasive elements. The idea was to reintroduce human characteristics to increase empathy between peers, albeit distant, during the lesson to draw the teacher's and peers' attention or to express their intentions and emotions.

After analysing the application scenario, the students began with their concepts' modelling and prototyping phase. The students adopted the following as design solutions: the addition of a second screen integrated into the robot's stem for personalisation and non-verbal communication, a light element that simulates the raising of hands and attracts the teacher's attention during the lesson, and finally, an external wearable device that enables the follow-me function, which is not yet present in current robots on the market Fig. 3.

This solution aimed to increase the user's possibilities of expression remotely by including means for non-verbal communication and introducing gestures to make transmitting the message via telepresence more effective. For example, with the introduction of the flash, an attempt has been made to introduce an element that is not too invasive and is easily visible by the teacher even from a distance. While the second screen was useful for close communication with peers, adding a degree of playfulness and entertainment to engage participants.



Human and instant interaction

The second concept was aimed at defining actions to make the interaction with the robot during group work more human by codifying recognisable human movements Fig. 4. This work aimed to increase the level of interaction and guidance by the users in their presence.

In this case, the students worked on a tracking system to recognise the non-verbal gestures of the subjects in their presence to interact with the machine and make it perform specific actions. Each gesture was encoded and transformed into action by the robot. A system capable of allowing the subject in the presence close to the robot to have more significant interaction and control of the machine. The student at home will then have feedback on the interface of the control device on the changes made by the machine in its presence. However, the system is not only limited to gesture recognition but also voice recognition of the subject (e.g., calling the robot by the subject's name from a distance) or recognising where sounds come from. This is because when working in groups where everyone is placed at a short distance from the robot, the robot can understand the direction of the voice call so that it is directed in favour of the person it is interacting with.

Fig. 3
Robot implementation with signal and follow me function. Credits: Abbate Lorenza, Germak Claudio.

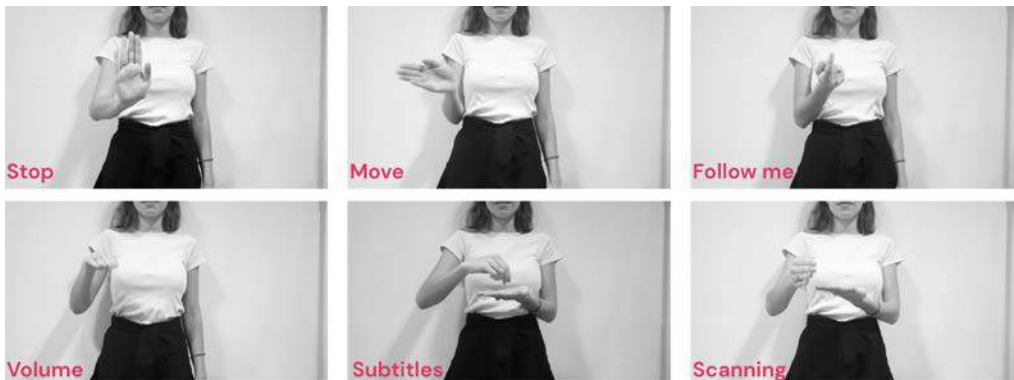


Fig. 4
Research on non-verbal gestures for commands to be transmitted to the robot. Credits: Abbate Lorenza, Germak Claudio.

Reflections on co-design experience

This contribution provides a framework for the design and flexibility of embodiment related to telepresence robots. A scenario highlighted potentials and limitations in characterisation through bodily, gestural, and vocal communication, which varies as the context/user changes. A work brought to light the need for social norms between people and telepresence robots, defining a series of reciprocal interactions made up of impulses and responses. This is because social norms assume that much of people's behaviour is influenced by how other social group members behave. Nevertheless, also because human preferences for anthropocentric interactions are often presented as the reason behind the humanisation of robots, i.e., that if people effortlessly apply the rules of human-human interaction to interactions with non-human beings and objects, then the humanisation of robots will result in more natural and efficient HRIs (Duffy, 2006).

The experience also suggests moving away from the current convention of a passive and static robotic body, looking at the contribution of new technologies, e.g., in terms of dimensional and social variation of intelligent components. It will be helpful to think about the potential offered by combining several technologies and approaches to the subject of machine characterisation between the physicality of the machine and the digital image **Tab. II**.

All these solutions will result from hybridisations between the analogue and the digital until we can use holographic robotic machines, in which our virtual holographic representation, in scale and in real-time, will be able to ride around on wheels.

USER CONDITION	ROBOT REQUIREMENTS	DESCRIPTION
Remote	Personal Characterization	Extension of the image of the user inhabiting the robot, providing physical and digital interface upgrades of adaptability to the environment
On-Site	Social Characterization	Social interaction of the robot with the place and subjects are physically present through behaviours that abstract human-human interaction

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Tab. II
Types of action based on the condition of the user and the requirements of the robotic system.

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Ethnographic Study: Finger Food Systems, Contribution to a Project Program in Food Design

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Abstract

This study consists of an ethnographic survey of 50 forms of finger food found by the author on the four continents of America, Europe, Africa and Asia, involving around 20 countries, presented under four morphological typologies wrapped, agglutinated, laminated and contained – and five construction systems – plate, oven, steam, water and bain-marie. The raw materials used in the collection are cereals (68%), pulses (16%), tubers (10%) and seaweed/leaves (6%). The literature review identifies exceptional qualities of combining whole grains with pulses as a dietary contribution to reducing obesity and improving public health. The results of this research will contribute to the author's PhD thesis: design of plant-based mobile finger food, mitigating the hegemony of wheat.

Keywords

Food design

Edible container

Finger food forms

Mobile food systems

(Re)qualification of public health

Introduction

What alternative products, from wheat containers to mobile food, exist in the world's cultures?

The aim of this research is to map and analyze world finger food systems, together with the systematization of the global food public health panorama, supporting the development of a Ph.D. research project in food design: the redesign and construction of a self-edible, plant-based food product for fly-food consumption.

This study will analyze the different ingredients and cooking methods that give rise to multiple constructive, organoleptic, and functional characteristics. In addition, the investigation aims to find healthier food alternatives in other non-European cultures to counteract the products manufactured with wheat flour-based pastes and under frying.

Methodology

Based on the scientific area of design, there is an articulation of technological, sociological, and cultural dimensions which, due to their complexity, were considered in the research design system model (Daymon & Holloway, 2011), encompassing complementary methodological approaches. Thus, we started from the analysis and review of the literature on the state of the art of nutrition and public health from the perspective of the Global Burden of Disease (Afshin et al., 2019), the National Institute of Statistics (Instituto Nacional de Estatística, 2021), the Childhood Obesity Surveillance Initiative: COSI Portugal (Rito et al., 2021), and the National Programme for the Promotion of Healthy Eating, Ministry of Health of Portugal (Gregório et al., 2019).

By observing and comparing globally diverse case studies of traditional and contemporary mobile food systems, we build a critical taxonomy under the ethnographic observation of mobile food design, constituting support for the project statement of food design. The methodology attempts to answer the “How?” as the “What?” and the “What for?” are responded to as we depart from finger food for an increment of public health.

The exercise included the comparative observation of different systems and materials (50 case studies) with a view to the pertinence of a new statement capable of designing new food products.

From the latest systematic analysis of Global Burden of Disease data, operating in 195 countries between 1990-2017, dietary risks from poor nutritional habits are responsible for 11 million adult deaths. Cardiovascular diseases were the leading cause of death, affecting 10 million (9 out of 10 deaths), followed by neoplasia, 20 million (17 out of 24 deaths), and type 2 diabetes, 24 million people (16 out of 33). 177 million deaths per year are due to poor dietary habits, leading to a 2/3 (67%) reduction in average life expectancy (the 5th most contributory risk factor), occurring in adults under the age of 70 (Afshin et al., 2019).

We thus infer that small daily eating habits significantly impact human health.

A deficient diet will originate consequences such as diseases of the circulatory system (45% of the total), diabetes and kidney diseases (1,6% of the total), neoplasms (1,2% of the total), high plasma glucose, hypertension, high body mass index, alcohol consumption and high LDL cholesterol (Gregório et al., 2019, p. 15) constituting an alarming public health panorama.

It is observed that the factors of anticipation of human death, associated with poor consumption habits characterized by excess sodium and lack of whole grains and fruit, in the order of 50% of total deaths per year, exceed the value of deaths from smoking, 15% (Ritchie, Hannah Roser, 2013). But, assessing average life expectancy, it is also observed that the impact of poor diet is higher, reducing it by about 66% (Afshin et al., 2019).

Portugal was part of this study, integrating the 195 countries under analysis. As a result, in the results of the National Health Survey (2019), the high prevalence of obesity, as the leading risk factor, is observed.

More than half of the portuguese population (53,6%) aged 18 years, or more were overweight or obese in 2019. However, comparing these with the data from 2014 identifies an evolution of more than 0.8% (Instituto Nacional de Estatística, 2021, p. 24).

The reality in the infant class, according to the National Programme for the Promotion of Healthy Eating (Gregório et al., 2019, p. 13), is that approximately 41,6% of Portuguese children between 6 and 8 years old are already overweight or obese (a disorder that prevails mostly in boys), with a tendency to increase with age.

Since Portugal joined a network of European countries for child nutritional surveillance and education, in 2007, in the Childhood Obesity Surveillance Initiative (COSI/WHO Europe) program, the evolution of overweight and obesity in children has been negative. However, over the different years of study (2007 to 2019), there was a 22% reduction in the prevalence of overweight (reduction from 37,9% to 29,6%), as well as obesity (15,3% to 12,0%) (Rito et al., 2021), confirming that these monitoring systems have had highly positive consequences in promoting and changing health standards among the younger age classes.

In the last four decades, because of the growing increase in obesity worldwide, the precipitation of sentences demonizing the consumption of wheat - preceded by fat and added sugar - was generated, suspecting an addictive behavior. However, according to Brouns (2013) the attribution of the cause of obesity to a specific type of food or food component is incorrect since the consequence derives from excessive energy consumption combined with lifestyle inactivity. Nevertheless, researchers from Adelaide University (Australia) and Zurich University (Switzerland) observe a prevalence relationship between the total availability of cereals, rice, and corn and the emergence of obesity (You & Henneberg, 2016).

Rebello (2014), a researcher at the University of Louisiana, proves that the dietary association of whole grains with legumes is a factor in preventing and reducing obesity and, consequently, the diseases associated with it.

“Whole grains and pulses are an abundant source of macronutrients, micronutrients, and phytonutrients that contribute to their health benefits. These food groups differ in their structural and physico-chemical properties and have varying amounts of fiber, resistant starch, vitamins, minerals, and other bioactive components. However, they complement each other. Thus, traditional foods such as the combinations of red beans and rice [...] provide an improved protein quality compared to the individual foods because of their complementary amino acid profiles.

[...] Pulses contain substantial amounts of the B-vitamins and minerals important for human health, such as iron, calcium, and potassium, as well as phytochemicals: bioactive compounds, including enzyme inhibitors, lectins, oligosaccharides, and phenolic compounds.” (Rebello et al., 2014, p. 7029; 7032)

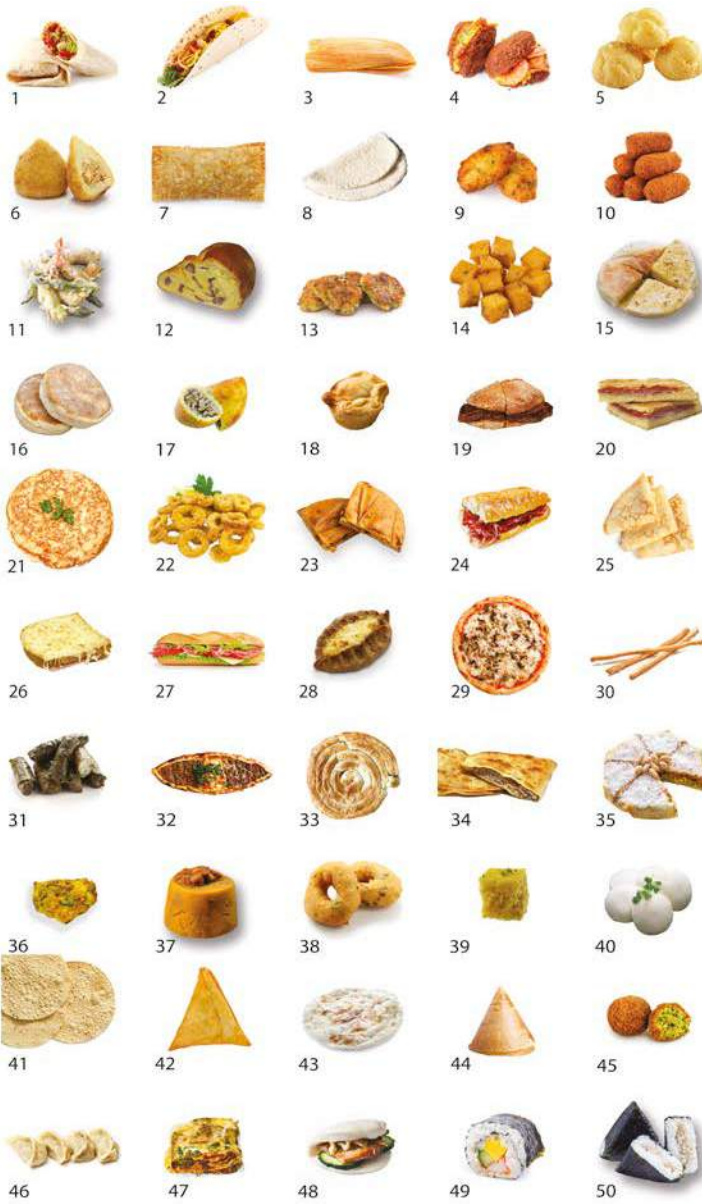
The author brought to discussion an essential contribution of the botanical group of legumes to food, namely the species of chickpeas, lentils, beans, peas, and lupins, whose consumption is well reflected in traditional portuguese gastronomy. Despite the low daily per capita consumption (1/4 of the recommended) as verified in the last National Food Survey 2015/2016 (Gregório et al., 2020, p. 45).

The finding of obesity reduction in consumers of whole grain cereal compounds with legumes will constitute a relevant contribution to the development of the author’s ongoing research, with a view to the design of new finger food containers. Furthermore, cereal pastes enriched with pulses acquire a recognized protein, vitamin, and mineral salts value (iron, potassium, and calcium) – approximately 50 to 65% of carbohydrates (starches), 20 to 40% of protein, 10 to 20% of fiber – will constitute a suitable alternative to the pastes traditionally used in Europe based on refined wheat.

Case studies

To answer the research question, we conducted an ethnographic survey of descriptive case studies relating to several globally diverse finger food systems (savory type) from four continents (America, Europe, Africa, and Asia). This observation identifies a set of forms resulting from the binomial raw material x construction system, reflecting specific cultures. Each of the examples presented was characterized by the following topics: territorial origin and respective original product designation, raw materials, typology of forms, and constructive taxonomy.

Fig. 1
Ethnographic survey
of hand-eating systems.
Authorship: Lígia Afreixo.
Credits: Istock, Deposit-
photos.



	AGGLUTINATE	CONTAINER	LAMINATE	WRAPPED	
MEXICO	Tamale - Mass flour paste containing an ingredient in an edible casing (maize, banana or banana stems), containing different fillings.			Buntes - Disk of compressed corn dough that conventionally holds different fillings. Faca - Compressed dough disk of corn flour, held in the shape of a disk, allowing the rolling out of a great variety of fillings. Pastosa casera - Filly based on cassava starch polymerized on the plate, allowing for different fillings.	
BRAZIL	Acaraço - Fried bean and onion paste ball under a frying.		Coqueiro - Enlarged ball of chicken coated in wheat paste, cooked in frying.		
	Paio de ovo - Balls of cassava flour paste and yolk cheese applied with egg, baked in an oven.		Coqueiro - Enlarged wheat paste stuffed with rice meat.		
PORTUGAL	Coelho daungado - Long ball of compressed codfish paste with potatoes, fried with egg and bread. Coqueiro - Cylinder of bread and mince meat paste, applied with egg yolk and wheat flour, coated with breadcrumb and subjected to frying. Faca - Thin disk-shaped wheat paste, enriched with egg and animal fat, including salted and aromatised pork belly, baked in an oven. Pastameia - Breaded wheat paste containing cod fish, subjected to regularly shaped frying. Paio de ovo (diferente do Brasil) - Corn paste cooked in water and seasoned, cut into cubes and fried. Paio de ovo (diferente do Brasil) - Breaded wheat paste, containing mince, formed in a high disc and baked in the oven, allowing for different uses and accompaniments. Paio de ovo (diferente do Brasil) - Breaded wheat paste, containing mince, ribs and eggs, formed in a high disc and baked in the oven, allowing different uses and accompaniments.	Paio - Cooked wheat flour ball, baked in a half-moon shape, filled with meat, top or vegetables and subjected to frying. Paio - Individual containers with the made of wheat flour paste, applied with meat, seafood or vegetables, baked in an oven. Paio de ovo - Wheat dough ball, enriched with egg, with slices of minced meat, baked in the oven, served to partners.	Paio de ovo - Wheat flour ball, enriched in rice, fishes and stuffed with meat or minced meat. Paio de ovo - Slices of eggplant or potato wrapped in a thin layer of wheat flour, containing soft egg, subjected to frying.		
SPAIN	Fartitas - Egg and potato agglutinated and subjected to deep frying.		Empanada - Flour pastry balls stuffed with meat, vegetables, wine or milk, baked in the oven.	Bocadillo - Various regional food products from cheese or canned fish, in a wheat bread slice. Chapas de empanada - Filled wheat bread stuffed with cheese and fish, prepared and cooked with tomato cheese paste for its grain. Paqueta - Variety of bread, based with an irregular shape and which is to be baked and filled with cheese, smoked products or vegetables, sometimes agglutinated with mayonnaise and agglutinated into structure.	Casaca - Spiced sections in rings surrounded by wheat and corn flour batter, subjected to frying. Chapas - Flour disk and egg placed on the grill, baked and rolled out like an empanada with various fillings.
FRANCE				Chapas - Flour disk with various (herbaceous), meat with tomato paste and cheese, baked in the oven. Domato - Vine leaf agglutinated various things (usually minced meat with rice), baked.	
FINLAND	Kanariainen Paletti - Rice flour and corned milk dough-shaped pastry with rice or malted potato filling, baked in an oven.				
ITALY	Coqueiro - Bread baked in the oven, made of wheat flour dough, which can be coated in accompany paste or yolk.				
GREECE					
TURKEY	Piye - Pastry made of wheat flour in the shape of a ball, with a filling of minced meat, baked in an oven. Borek - Filling of meat in containers through the pastry (wheat flour), baked and cut into slices.	 			
ARMENIAN	Qutab - Thin disk of wheat paste cooked on a grill and fried in half moon, filled with cheese, herbs and sometimes zira nuts.				

	AGGLUTINATE	CONTAINER	LAMINATE	WRAPPED
RUSSIAN	Beleto - Pull pastry disk with a mince and vegetable meat filling, baked in the oven.			
ROMANIAN	Acuji - Bean flour or chickpea flour mixed with other seasonings and agglutinated in both under frying.			
NEPAL	Phan Chan - Bean paste, pouring with fat and butter, egg, wrapped in banana, leaf and cooked in a hot steam.			
INDIA	Paio - Breaded mung bean paste, formed into ring and fried. Chutney - Chickpea noodles, steamed or fry, cut into cubes. Paio - Breaded lentil or rice balls. Paio - Triangle of wheat flour paste with different vegetables or meat filling, subjected to frying. Paio de ovo - Bread made from wheat flour paste and yogurt, baked in the walls of a hot oven.	 	Paqueta - The wheat flour disk, fried and cooked, which encloses the region of sweet and spicy paste or sauce.	Qutab - A thin disk of wheat paste and cooked rice, surrounding sweet and sour filling and zira.
MIDDLE EAST	Paio - Fried chicken or fish bean paste dumpling.			
CHINA	Dumpling - Half-moon of fish dough made of wheat flour and corn starch, filled with minced meat or vegetables, steamed in a tray.		Paqueta - Wheat flour and mung bean flour mixture, with egg incorporated with a vegetable, herb and mince meat filling, cooked on the grill and baked like an empanada shape. Paio de ovo - A high disk of breaded wheat flour and milk dough, filled to steam in a hot of moist steamer. Paqueta - Fish wrapped in rice paste, cooked in vegetable broth, wrapped in rice, steamed and cut into small portions. Qutab - Triangle of rice paste with fat filling, fully fried with root vegetable.	
JAPAN				
	SPAIN (COCOA)	FRANCE (BEAN)	TURKEY (CABBAGE)	
	SPAIN (MILK)	FRANCE (CHICKEN)	TURKEY (POTATO)	
	SPAIN (LENTIL)	FRANCE (LENTIL)	INDIA (LEAF)	
	SPAIN (RICE)	FRANCE (PASTA)	ARMENIA	

Tab. I
Ethnographic survey of food systems for eating by hand: product name, territorial origin, shape typology, raw material and constructive taxonomy (agglutinated, container, laminated, and wrapped).
Authorship: Lígia Afreixo.

The selection of the 50 case studies presented results from knowledge acquired through travels, documentaries, reviews of specialty literature, and research on online platforms.

From the comparative analysis of the data in the table above, we found that half of the observed models are wheat-baked products and that in the whole set of cases, 2/3 (68%) use cereals (50% wheat, 14% corn, 2% rice and 2% rye). The remaining 1/3 (32%) is made up of 16% legumes (beans, chickpeas, and lentils), 10% tubers (potatoes and cassava), and others (6% vine leaves and Noori seaweed).

Despite the reduced number of typologies considered – agglutinated, container, laminated, and wrapped –, the 50 cases studied are differentiated by an infinite number of flavors and different implementations, extending the organoleptic domain of the form, a manifestation of an enormous human creative potential of adaptation to each geography and culture.

Regarding constructive characteristics, we studied the method of making and combining the basic raw materials that allow us to obtain a specific type of shape.

Throughout our research, we realized that specific food model that today partially or totally integrate wheat were in the past produced from other raw materials such as legumes (chickpeas or lentils). In China, fast food products predominantly made from rice are now being replaced by wheat. This food shift towards an international hegemony of wheat is justified by the economic accessibility of a product massively cultivated by China, India, Russia, the United States, and France, which produce about 52% of the wheat made worldwide. When today, and in the portuguese market, we compare the price of wheat flour with other cereal flours and with dried pulses; we see that chickpeas cost 1,4 times as much as wheat flour, lentils twice as much, dried beans and corn and rice flour more than twice as much. With the necessary corrections of scale, the cost of wheat is recognized as favorable to the hegemony of its consumption by westernizing eating habits in today's globalized world.

Despite the low economic relevance of legumes and other plant foods (such as tubers, leaves, and seaweed), there are nutritional qualities of proteins (collagen), vitamins, minerals, and starches that may offset the cost difference. However, the main advantage will be combining whole grains with legumes, according to Rebello (2014), which is associated with a proven weight rebalancing factor, reversing the accumulation of visceral fat and the whole set of pathologies associated with it.

Through the ethnographic comparison of cases by similarity or difference, it was possible to understand and systematize the different morphological families to which each product belongs. Thus, we identified four significant typologies: containers chemically transformed by steaming, grilling, baking, or frying, confining fillings, and originating products such as rissoles, pies, *empanadas*, *gyoza*, *samosa*, and meat pasties. The laminated products consist of products that are layered in parallel layers. Food pastes can physically aggregate this typology. We find sandwiches and certain types of puff pastry, *croque monsieur*, and *Prego no pão* (Beefsteak sandwich). The case of wrapped products consists of wrapping materials with other elements such as cabbage or vine leaves, seaweed, corn or wheat disks cooked on a plate: the dolmade, the taco, or the sushi.

Finally, the agglutinates, pastes, or elements aggregated by chemical means, are subjected to frying or baking, such as croquettes, *tortillas*, codfish dumpling, *falafel*, or *moin moin*.

The consideration of this collection of shapes and constructive systems may contribute to the design of new food solutions, which we intend to develop in the scope of the ongoing Ph.D. thesis project, testing new material combinations by reducing the percentage of de-husked wheat and introducing whole wheat, combined with tubers, pulses, vegetables or fruit. The result to be prototyped will also be characterized by organoleptic and communicational aspects, assigning chromatic and morphological codes to the different fillings, exploring both the nutritional modularity of the products and the playfulness of their consumption.

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Exhibitions as Hybrid Environments. Exploring Situated & Embodied Interaction in Cultural Heritage

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Abstract

The paper focused on the transformational aspects of narrative and experience modalities in the field of exhibit design when intertwined with digital technologies. In particular, the convergence of blended realities provides a *phygital* experience, based on interaction with physicality and with digital environments, where these hybrid, interactive, and interconnected communication ecosystems offer opportunities for experimentation.

Keywords

Exhibition design
Digital storytelling
Phygital interface design
Space-based interactions
Blended reality

***Phygital*: a paradigm shift in embodied and situated experiences**

The intersection between exhibit design and digital technologies, which dates to the 1990s, the early years of the Internet revolution, has created an innovative field where to experiment with the transformative processes of narrative approaches and innovative modalities to interact and dialogue with people accessing cultural *environments* whether real or cognitive.

Besides, this convergence is part of the blurred realm of the so-called *phygital* scenario, a blended space where *real* and *virtual* (here intended as technologically mediated or enhanced *reality*) collapse together generating a hybrid, interactive, and interconnected communication ecosystem to be further explored. Crisis of 'physical' and 'digital', the word was invented by the Australian agency *Momentum*, which claimed the copyright in 2013. Originating in marketing and retail field, the term is spreading in several different contexts.

The pervasiveness of technologies, in fact, is impacting the relationship we establish with the word creating new existential ontology, such as the *onlife*, and, indeed, patterns and behavioural archetypes with unprecedented potential to be further explored and designed.

In the last two decades, two trends seem to emerge in the evolution of Cultural Heritage disciplines, and in the locations traditionally aimed at preservation, curation, and dissemination, i.e., galleries, museums, archives, and libraries. Trends that are reshaping knowledge access and cultural habits both in temporary events as well in permanent exhibitions. Either way, the offering of content and, consequently, the means of presenting and displaying it, is increasingly articulated around the paradigm of "narrative" (Trocchianesi, 2014, Borsotti, 2017, Atelier Brückner, 2018). A concept, the latter, that implies rethinking the modalities of communication and interaction when approaching the language of digital-mediated or augmented – experience. The new exhibition and experience design horizon is based on the coexistence and integration of both ends of the spectrum – physical/analogical and digital/virtual – and the many intervening declinations such as blended, hybrid or cross realities of the *phygital* scenario. But as often happens in contexts where technology revolutionises existing frameworks or creates novel ones, the challenge, especially for the design, is how to shape this original *materiality*.

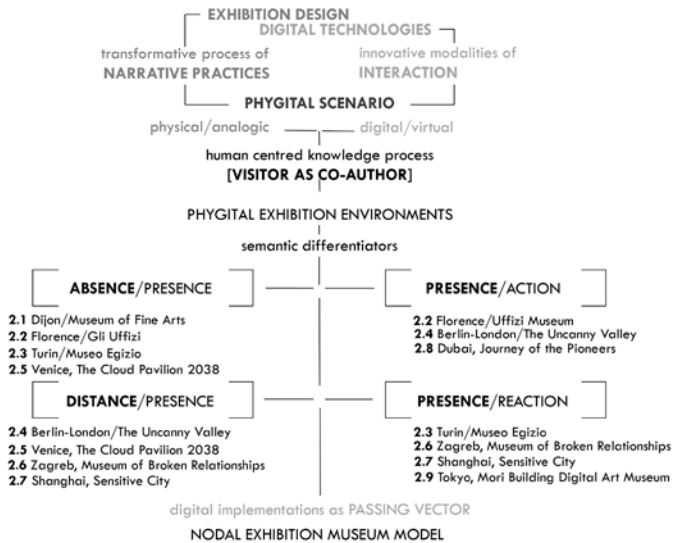
The latest travel, movement and meeting restrictions forced by the pandemic have prompted a further acceleration in this direction, which results need yet to be mapped, understood, and verified in a medium to long-term analysis and comprehension process. Additionally, but with dynamics that suggest important areas of complementarity, unprecedented approaches have been developed to the world of contemporary iconographic and media cultures, investigating the pervasive real-time availability of images/audio/video, in terms of potential innovative forms of knowledge (Manovich, 2020). Even the *stories* and audio-video clips generated and shared by users and available on many visual social media such as Instagram (Rossi, 2021), TikTok or Twitch – very popular among the younger people of the Alpha generation – can be, in fact, reinter-

preted as cultural values and themselves. We are probably experiencing a first phase, still as blurred as it is disruptive, of a radical transformation of the ways in which culture is made available, disseminated, and experienced. The traditional tools adopted in exhibits, and the places institutionally appointed to them (the before-mentioned GLAMs and primary museums) are evolving, welcoming, and developing models inspired by multicultural education and responsible knowledge, often adopting hybrid collaborative learning systems that place individuals and collectivity at the core of their approach also through innovative use of technologies and life-centred design approaches. The interaction of these models, in fact, leads to new ways of communication and the fruition of cultural heritage, starting from “traditional” works of art, up to immaterial heritage, including the new horizon of the native or totally digital ones such as the emerging NFT. (Sassoon, 2019, Bonacini, 2020, Colombo, 2020) The concept of culture as it is proper to the humanities – understood as material and objective expression, at the basis of the collections of artefacts such as manuscripts, films, and other media in museums – is combined with that at the basis of cultural anthropology, which focuses on language, behaviours, ideologies, and cultural expressions. Moreover, the performative dimension (Bollini, 2021), typical of “phygital” interactions, mediated by digital and presence/corporeality becomes an act of bottom-up/grass-root cultural construction/production (Jenkins, 2012, Bernardo, 2017) integral to the knowledge process itself. The intersection of these new paradigms favouring, on the one hand, experiential interaction (guided by storytelling design) and, on the other hand, the humanization of technology as a mediation of the experience itself with physical, cognitive or virtual space, constitutes the focal point adopted by this research, which interprets the project of cultural heritage valorization through augmented and enabling digital experiences, according to an ecosystem, holistic and human & humanity-centred vision. Exhibition design, therefore, is experimenting with alternative and complementary models of itself in which humans are at the center of a communicative ecosystem hinging on interaction and interpretation. The visitor (where previously the object, the collection, prevailed), in fact, is the centre of a co-actor/co-author knowledge process, thanks to the active cognitive, perceptive, and bodily participation in a renewed balance between design and technologies.

Building an experimental grammar of phygital exhibition environments

At the level of research methodology, a conspicuous number of cultural events of an exhibition character were mapped to better understand the evolution and outcomes of the transformation process outlined thus far and to verify, on the one hand, the consolidation of narrative practices rooted in the overall conceptualization-curatorial-installation ecosystem and, on the other, how and to what extent these practices developed through the introduction and implementation of digital media and tools. For this paper, several paradigmatic case studies have been selected, herein synthetically analyzed, through the introduction of two characterizing keywords or, rather,

semantic differentiators Tab. I — *absence/presence, distance/presence, presence/action, presence/reaction* — that define the conceptual model of access and relationship established between visitor and content. In addition, spatial categorizations have been developed, useful to constitute an initial experimental ‘grammatical’ basis for the definition of new *phygital* exhibition environments, consisting of innovative hybridizations between the act of narrating and that of showing, where the changing role of the visitor is increasingly active and integrated.



Tab. I
Research framework and semantic differentiators diagram. Credits: Marco Borsotti & Letizia Bollini.

Museum of Fine Arts, Dijon (France):
socially mediated hybrid space

An interesting case that shows how the constraints of the COVID emergency create an opportunity is represented by the blood collection operation organized inside the building of the Museum of Fine Arts in Dijon in spring 2021. “It is by saving lives that the people of Dijon have the opportunity to admire the works exhibited in the famous Museum,” Christine Martin in charge of the local French Blood Establishment explains “Let’s take care of bodies and take care of our imaginations, let’s open museums, it’s a place that will do us good” (Archyworldlys, 2021). Many of the cultural mediators volunteered during the event offering the donors short comments on the 18th century rooms of the museum or, delivering an explanation when asked about the paintings, making the medical procedure and occasion to cultural discovery and fruition.

Gli Uffizi, Florence (Italy):
a socially curated hybrid space

On the opposite side of the possible spectrum of the dichotomy of absence/presence is possible to identify the experience carried out by the Uffizi Museum. Active on the web since the 1990s, the museum has been experimenting with social media and influencers creating a convergence between contents curated by the institution itself and the public. Teasing and funny videos on TikTok, as well as *stories* and pictures shared on Instagram, create an interplay of mirrors in which the public and influencers – in this case, Chiara Ferragni, invited to visit the gallery, approaching the Botticelli's Venus, as a modern icon of beauty – intertwine a narrative of gazes, references in which the ultimate focus is the exhibition space and the cultural object to be appropriated rather than displayed. The curation strategically addresses the *Alpha* and *Z* generations and their different perception of the cultural heritage (significantly increasing the visits to the museum by young and very young people in the subsequent weekends by +27%).

Museo Egizio Turin (Italy):
distance and co-presence in hybrid space

Similar, and at the same time, opposite the Museo Egizio made a synergic use of one of the Eurovision 2022 preparatory events hosted in Turin. The museum organised a visit – an activity traditionally linked to exhibition culture – and a concert. The protagonist was one of the finalist groups of the European contest, *Eugenio in via di Gioia*, a local folk/indie pop group involved in the promotion and therefore locally rooted, who played inside the museum. Experienced in presence/ in situ by a group of young people who were guided in the evening hours, after closing time, the performance was streamed on TikTok.

Dissolved. The Uncanny Valley:
presence in distance in the hybrid space
Florian Feigl + Christopher Hewitt - Berlin (Germany), London (UK)

Conceived back in 2014 the telematic performance is acted at the same time but displaced in London and in Berlin. It well exemplifies the intersectional space of a possible choreographic experience in which a combination of distance, overlapping, augmented space and *co-presence* allows the actors to play a collective action although dislocated in two different places. The artistic project thus challenges the very concept of co-presence – space/time – as we experienced it during the lockdowns. As art often does, it prefigures a translation of human experience through the narrative language of experimentation. The interaction is choreographed, and I use the hybrid space of the immaterial image as an interface for the gestures of the people whose presence-in-another-place and in-situ-distance stratifies on a figurative/performative level, as much as on an emotional/unconscious level a shared experience that is both deprived and augmented. A physical element – the door in the left corner of

both sceneries – is metaphorically the osmotic membrane where the presence and distance collapse and reconfigure themselves in an otherwise impossible combination.

The Cloud Pavilion. 2038 - The New Serenity: dislocated space
*German Pavillion, 17th Biennale di Architettura
di Venezia - Venice (Italy)*

The German Pavillion of 2021 Biennale offers an experience as alienating as it is close to everyday life. A majestic exhibition space in its physical proportions – a device of display in which the spectator is bodily present and situated – completely empty. Stripped of all material and figurative elements, except for the QR codes that refer to *another* space, the exhibition is absent. Or rather, it is dislocated into another physical and narrative dimension: the *cloud* pavilion. An application that simulates a three-dimensional space – a metaverse – where two artificial genderfluid intelligences converse with people narrating combinations of present, possible, and desirable futures set in 2038. Presence and present become a paradox, in which antitheses coexist thanks to the *phygital* interpenetrating the two physical and temporal planes of perception.

Museum of Broken Relationships,
Zagreb (Croatia): literary hybrid space
Olinka Vištica and Dražen Grubišić

A matter of absence and presence. The process of identification and emotional involvement is at the heart of this museum and its format. Its collection, in perpetual evolution, is composed of everyday life objects that belonged to ordinary people and that became iconic in representing the failure of their love story. Being given to the museum, these objects immediately change status as a part of a collective act of catharsis and overcoming a personal love drama. Indeed, they become unexpected precious memorabilia to be exhibited exclusively by the intimate personal emotional significance that characterizes them one by one and that is explicitly declared by the anonymous contributor, through a brief text that clarifies the meaning. Fig. 1



Fig. 1
Olinka Vištica and Dražen Grubišić, Museum of Broken Relationships, Zagreb, Croatia 2010. 2nd Zagreb display. The object and its story are displayed together. Courtesy Museum of Broken Relationships. Copyright Museum of Broken Relationships. Image by Nataša Njegovanović.

This text is requested, as a cardinal principle of the curatorial concept and it became an integral part of the object. The presence (and centrality) of the narrative value is, therefore, made explicit in the exhibition apparatus. Also, it constitutes a relational system that links the physical object to the tale of its metaphorical value. In this way, a game of absences (the object's original owner, and its donor) and presences (the object, its idealization, but also the drama and its overcoming) is triggered, meanwhile, the pain of the individual's experience immediately enters harmony with a collective experiential bearing, as a common heritage of lived life. The textual contents, therefore, contextualize the intimate, symbolic, dramatic meaning of the objects, elevating them to the status of a representation of an individual memory (Halbwachs, 1987, Assmann, 2002) that offers itself as a shared collective experience, according to a process of appropriation that, moving from the narrative level, transforms the inquiring curiosity into an intense process of emotional self-identification involving body and soul. Fig. 2



Fig. 2
Olinka Vištica and Dražen Grubišić, Museum of Broken Relationships, Zagreb, Croatia 2010. 2nd Zagreb display. The object and its story are displayed together. Courtesy Museum of Broken Relationships. Copyright Museum of Broken Relationships. Image by Mare Milin.

The space set up, therefore, is realized by the succession of signifying binomials (the object and its intimate description), stages of hybrid literary environments. The digital presence is still absent, but the evocative power of narration proves fundamental.

Sensitive City. "Portatori di storie": humanized hybrid space
Studio Azzurro - Italian Pavilion, Shanghai World Expo 2010, Shanghai (China)

A matter of presence and distance. The project was born in reason of the willingness to introduce Italy into the planetary scenario of an international Expo. Referring to the utopian principle of the "ideal city", typical of the Italian Renaissance tradition, this is rediscovered in the contemporary world, thanks to the accounts of the everyday reality of the inhabitants of six Italian cities. These small-sized cities – Lucca, Trieste, Siracusa, Matera, Chioggia, and Spoleto – share a high quality of life, as well as the beauty of their architecture and territories. The *Storytellers* become the protagonists of a portrait that narrates the value of their community, through the uniqueness of their individuals, adopting simple words so spontaneous.

With their faces, voices, and gestures, the *Storytellers* nullify the human distance between the Chinese Expo visitors and Italy, but above all the distance between their virtual presence, made possible by digital technology, and the physical one of their listeners. Fig. 3



Fig. 3
Studio Azzurro, Sensitive City. "Portatori di storie". Italian Pavilion, Shanghai World Expo 2010. View. The visitor gets in touch with the narrator. Courtesy Studio Azzurro. Copyright Studio Azzurro.

However, the *Storytellers* remain silent until their interlocutors offer them their hands. Only through one of the most common and spontaneous human gestures (as well as typical of Italian and Western culture) can a virtual friendship begin, which then returns, in dialogic form, the sensitive, lived experience of the city. Fig. 4

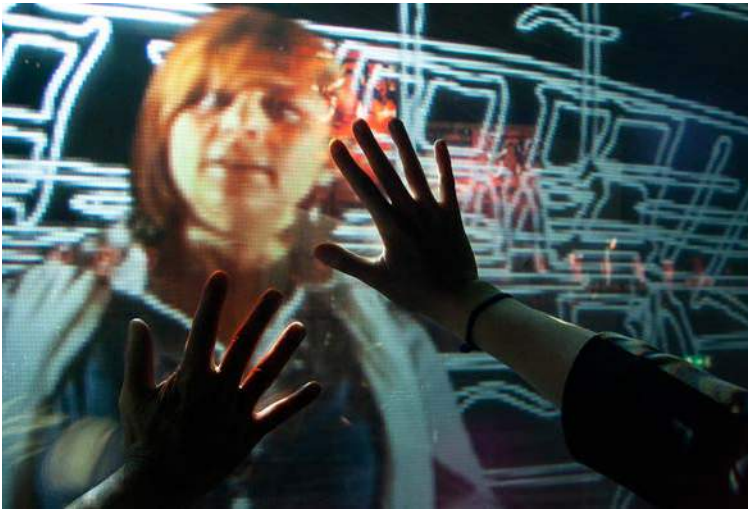


Fig. 4
 Studio Azzurro. Sensitive City. "Portatori di storie". Italian Pavilion, Shanghai World Expo 2010. Detail. The narrator starts speaking. Courtesy Studio Azzurro. Copyright Studio Azzurro.

Sensitive City appears to the visitor as an interactive path in which one can interrogate each character with a simple gesture, generating a space made up of relationships, memories, dreams, and fears and drawing a path in continuous transformation, capable of preserving and handing down the traces of its *storytellers* (Studio Azzurro, 2010).

Museum of the Future,
 Journey of the Pioneers: interfaced hybrid space
Atelier Brückner - Dubai (United Arab Emirates)

A matter of presence and action. Realized by Atelier Brückner, a pioneer of the concept of narrative in the field of mixed exhibition design, the exhibition Journey of the Pioneers, introduced at the Museum of the Future in Dubai, aims to visualize the possible future of mankind, 50 years from now, through the extensive use of multiple digital technologies, to convey a multi-sensory experience that leads visitors into a vision of possible human progress, located in 2071.

Several immersive future scenarios are offered in a combination of exhibition languages that weave together the traditional 'staging' of objects, active theatrical involvement, and thematic attractions. The visit progression is held by the presence of digital holograms and interactive and immersive projections, which give access to virtual and at the same time sensorial worlds. Fig. 5



Fig. 5
 Atelier Brückner. Journey of the Pioneers. Museum of the Future, Dubai, United Arab Emirates 2022. The Library. An interactive installation and an immersive ecological archive of our planet's biodiversity. Courtesy Atelier Brückner. Copyright ©Atelier-Brueckner. Image by Giovanni Emilio Galanello.

Here, the narrative structure is mediated and enhanced by the continuous stimulus proposed to the visitors. At the same time, they are the makers of the action (by activating the digital implementations) and the actors of it (thanks to the strong immersive vocation of the situations to which he has access). In this sense, the museum is one of the most advanced representations of an interfaced hybrid exhibition space. **Fig. 6** Between anthropic and sci-fi visions, the visitor's physical presence is virtually dematerialized in a futuristic projection of it.



Fig. 6
 Atelier Brückner. Journey of the Pioneers. Museum of the Future, Dubai, United Arab Emirates 2022. The Lab. A multi-sensory, immersive tropical ecosystem simulator where flora can be introduced and tested. Courtesy Atelier Brückner. Copyright ©Atelier-Brueckner. Image by Giovanni Emilio Galanello.

Three levels show immersive future scenarios: The first is a Space Station, followed by the HEAL Institute, an organization that has the task of regenerating damaged and endangered ecosystems. Finally, the visitors come to ALWAHA, a space for our wellbeing and senses. (Atelier Brückner, 2022).

A matter of presence and reaction. Inside this museum, visitors dialogue with a digital aesthetic explicitly proposed without any hierarchical logic or predetermined paths. One thus enters large rooms, real-phygital-rooms, generally free of encumbrances and objects, which instead leave room for multiform and colorful digitalized presences, which react and change human presence. The exhibition space is therefore interpreted as an opportunity for an immersive experience, where the movement of people intercepts the digital representation, thus determining unexpected and changing configurations. The human presence acts as a catalyst for the digital actions and reactions, in a hybridized scenario, becoming itself the matrix and the beneficiary of the continuous redesigning of the collection. It is an immersive and performative experience that generates sensorial and emotional involvement.

So it is that in a large room, one physically walks in water, which reaches one's ankles, while an algorithm coordinates and reconfigures projections of swimming carp and floating flowers based on the interactions generated with those present. The digital homage to these traditional Japanese symbols both evokes and engages people and technology, in a kind of rhythmic dance from bodily perception to sensory stimuli. In the museum, each experience triggers a narrative sequence that could be summarised as surprise/immersion/surprise, as real distances turn into virtual ones.

The nodal exhibition model

The exhibition spaces – primarily museums – can be assumed, as 'bubbles' with their own casing (usually an interior) and the visitors who attend them as smaller individual bubbles which, on accessing them, merge into larger ones. The latter accessing the former, merge into larger bubbles. This proxemic ecosystem (Hall, 1968) has been severely penalized by the unexpected and forced dimensioning caused by the pandemic period, as the available spaces have had to *give* a surface to pure distance, and consequently, their *bubble/involucre* has become a very limited container. Starting from these conditions and thinking about the question of triggers between the physical and virtual relationship faced by visitors in an exhibition space, we propose to imagine redesigning exhibition spaces and museums as a linear system. In this vision, they are then placed as nodes in a structural system defined by intertwining lines (individuals) whose trajectories they intercept by the narrative and enhanced and made virtually unlimited by digital technology. Starting from Tim Ingold (2020) anthropological studies and referring to his interpretation of the social relationship between *bubbles* and *lines*, we think it could be possible to propose an interpretative model for the new challenges facing exhibit design and cultural heritage in contemporary times.

"In general, we like to think of people and organisms as globes or Bubbles. Bubbles have an inside and an outside separate from the surface. They can expand and contract,

enlarge and shrink. [...] What bubbles cannot do, however, is hang on to each other, at least not without losing their distinctiveness in the intimacy of embrace. When they merge internally, in fact, their surfaces dissolve to form a new exterior. [...] My thesis is rather another, namely that in a world of bubbles there could be no social life: for since there is no life that is not social - that does not involve an interweaving of lines - in a world of bubbles there could be no life of any kind. [...] Where the bubble confirms the principle of territorialization, the line confirms the opposite principle: deterritorialization". (Ingold, 2020, Chapter 1, Linea e bolla)

In the same way, by the *phygital* model and its experimental grammar, a sort of dynamic deterritorialized exhibition is generated, in which the relationships of dissolution of the physical perception of ourselves, caused by distancing, would be restructured into a more fluid and flexible structural vision, where digital implementations could play an innovative role of *passing vector*. We could, therefore, speak of a *nodal exhibition/museum model*, which identifies linear flows of information into which it fits, by intercepting lines of confluence and tracing innovative and unexpected interweavings at the level of space and individual. Or, better to say, place and knowledge. In this way, space and place become hybrid configurations between corporality and virtuality. A model that ties culture back into the flow of experience and defines a reticular presence of the exhibition space, both in its development within the set-up space and in its digital connection to any other *external* space involved. According to the *nodal model* the knowledge process is triggered to transform the role of the visitor in a renewed balance between design and technology, without renouncing gestuality and physicality, which means a *phygital* experience of knowledge – embodied and situated – mediated by the digital space

Conclusion

The research project aims to explore and investigate systematically the evolution of media and exhibition languages and practices, social challenges, and cultural experiences through a Design-Driven Innovation perspective, with a particular focus on situated and embodied interaction and creative social practice in the field of cultural heritage valorization

In particular, the aim is to investigate the multiple aspects of the relationship between people/users, the narrative component of the setting, and the multiple nature of space, considered in the broadest spectrum of hybridity: physical/phygital/virtual. Among the aspects considered are the relationships between absence/presence, distance/presence, presence/action, and presence/reaction, both in theoretical and disciplinary terms and from the point of view of practice-based research.

The expected result is a first critical mapping and conceptual interpretation of best practices and to propose a possible specific framework in the field of design for social innovation.

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Author Roles Acknowledgement

Although the paper is a result of the joint work of all the authors, Letizia Bollini is, in particular, the author of paragraphs 1 to 2.6, and Marco Borsotti is the author of paragraphs 2.7 to 4.

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Brain Training, Mindfulness, and Wearables: Empowering Employee Wellbeing Through Neurotechnologies

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Abstract

In this article we will report on the application to the business context of the Brain Wellness program, a technology-driven service that aims to enhance the cognitive abilities and performance of people in the workplace using methods that are based on neuroscientific research. The neurotechnologies used in the Brain Wellness program are three. The *Lifestyle Assessment Lab*, by measuring with a biofeedback sensor the heart rate (HR) and its variability (HRV) over 24 hours, tracks some important parameters about the person's lifestyle, like the sleep quality, the stress-recovery balance and the effect of physical activity. The *Mindfulness Lab* aims to enhance the work performance of people by decreasing their level of stress and anxiety through the exercise of awareness and attention on a digital platform and group coaching sessions. The Cognitive Training Lab aims to enhance people's work performance through executive function exercises.

Keywords

Neurotechnologies
Biofeedback
Wearables
Mindfulness
Cognitive training

Introduction

Today we are on the cusp of the Fourth Wave of the Industrial Revolution (Schwab, 2017). It is a technological change that is characterized by the widespread application of cyber-physical systems in manufacturing production environments, and by the combined presence of information technologies with biological ones, which according to Harari (2014, 2018) could restructure not only economies and societies but also our bodies and minds. The main breakthroughs in biotechnological development driving the Fourth Industrial Revolution are centered on genetic technology and neurotechnology.

Neurotechnology can help us monitor brain activity and our nervous system, observe how the brain changes and interacts with the outside world. The goal of neurotechnology is also to give human systems a performance advantage over robotic machines, while increasing the (real and perceived) level of human well-being. Neurotechnology is at the basis of so-called *transformative technologies*, born out of the need and desire of a segment of the population to achieve an improvement in mental performance and to seek positive emotional conditions.

In this article, the application of three types of neurotechnologies to the business context will be discussed:

- **Biofeedback:** Wearable sensors have gained significant attention and adoption in various industries, including business contexts. These sensors can collect real-time data about an individual's physiological and behavioral parameters to assist them in learning cognitive and emotional self-regulation skills with the aim of improving their functioning and/or performance (Perez & Zeadally, 2021). In practice, biofeedback involves a software and hardware system to monitor specific physiological parameters (e.g. HR and HRV). From a human-computer interaction (HCI) perspective, wearable sensors facilitate the interaction between humans and technology by seamlessly integrating into daily routines. They provide a non-intrusive and convenient way to track and manage well-being without disrupting the user's workflow. Moreover, advancements in sensor technology and miniaturization have made it possible to incorporate sensors into clothing or accessories, further enhancing the user experience and reducing the burden of wearing additional devices.
- **Mindfulness:** the term *mindfulness* is translated from the Indian Pali language (the one used by the Buddha) to mean mostly 'awareness'. Mindfulness meditation has gained popularity as a practice to enhance well-being and productivity in business settings (Hülshager et al., 2013). It is specifically a broad set of contemplative practices aimed at regulating attention, emotions, and the self (De Pisapia & Gregucci, 2017). The positive effects of mindfulness practice have long been verified and range from decreasing stress and anxiety to improvements in cognitive functions, such as working memory and attention, to slowing down physiological ageing (Goleman and Davidson, 2017). From a HCI perspective, technology can play a supportive role in promoting mindfulness. Mobile applications and digital platforms offer guided

mindfulness meditation sessions, reminders, and progress tracking, making mindfulness practices more accessible and engaging. These tools can help individuals incorporate mindfulness into their daily routines and establish regular practice, ultimately improving their well-being.

- Cognitive training: this is a process that, through practice and intentional learning by means of serious games, allows for improvements in the performance of the skill being trained, but can also have broader and more generalized effects on somewhat related functions. Cognitive training is a strand of research in the field of cognitive neuroscience, which has also developed a market trend (better known as 'Cognitive Fitness' or 'Brain Fitness') that has been developing rapidly for at least a decade, mainly in the North American market. There is evidence showing the effectiveness of cognitive training protocols for improving worker performance in different settings (e.g., Jaeggi et al., 2011; Titz & Karbach, 2014), including the corporate one. From a HCI perspective, technology plays a crucial role in cognitive training. Computer-based cognitive training programs provide interactive and engaging exercises that target specific cognitive skills. These programs often adapt to the individual's performance, tailoring the training to their specific needs and abilities. Additionally, virtual reality (VR) and augmented reality (AR) technologies are being explored as tools for immersive and engaging cognitive training experiences.

It's worth noting that the field of wearable sensors, mindfulness meditation, and cognitive training is dynamic, and new advancements are continually emerging. When combined, these three technologies offer a holistic approach to design studies. By leveraging wearable sensors' data, designers can gain objective insights into user behaviour, while mindfulness practices foster empathy and subjective understanding. Meanwhile, cognitive training enhances designers' cognitive abilities, empowering them to tackle complex design challenges with clarity and creativity. Together, these elements contribute to the development of user-centered, innovative, and impactful designs in the field of design studies.

The Brain Wellness program is a technology-driven service aimed at enhancing people's cognitive abilities and performance in the workplace. The proposed enhancement methods are based on neuroscientific research and neuro-plastic capacities, i.e. the ability of the human brain to improve its structure and functionality as a result of validated mental training protocols and techniques. Companies can implement transformative experiences for the training of their personnel, with a focus on the topics of mental capital, well-being and stress management for their staff. In response to these needs, we propose our own scientific approach based on current knowledge about the human brain.

The aim of this transformative experience is to develop original empowerment programs based on scientifically validated protocols, through the design of multimodal environments, the use of digital tools, and the implementation of training and coaching interventions.

Brain Wellness programs are divided into three labs:

- Lifestyle Assessment Lab,
- Mindfulness Lab,
- Cognitive Training Lab.

Lifestyle Assessment Lab

The Lifestyle Assessment Lab uses a wearable ECG sensor to measure HR and HRV over a 24-hour period and for a total duration of 72 hours (2 working days and 1 day of free time), tracking a series of physiological parameters: stressful events, the quantity and quality of recovery during the day and night, physical activity, and its effects on improving health. The data recorded by the sensor allows for an objective assessment of lifestyle and enables a series of personalized recommendations to manage stress, get the most out of recovery time, and exercise at the right intensity.

Using a biofeedback sensor, participants (18 employees of an insurance company) were able to assess the quality of their lifestyle by correlating it with well-being and work performance.

The sensor uses HRV over a 24-hour period to identify a number of physiological parameters such as:

- The stress generated by certain events,
- The quantity and quality of recovery during the day and night,
- Physical activity and its effects on improving health.

After taking part in an introductory workshop held by experts in the fields of biofeedback, neuroscience and physiology, participants wore the sensor for 72 consecutive hours (two working days and one day off). The measurement was repeated twice, eight weeks apart during which the participants took part in mindfulness training designed to reduce their stress levels.

At the end of the two measurements (pre- and post-assessment), the results were compared to highlight the objective improvements achieved through the mindfulness training.

- After 8 weeks of mindfulness training, in 18 participants:
- Sleep duration increased by 3%,
- Recovery during sleep increased by 3%,
- Quality of recovery during sleep improved by 14%,
- Stress level during the day decreased by 12%,
- Recovery time during leisure increased by 35%,
- Recovery time during work increased by 23%,
- General well-being score increased by 7%.

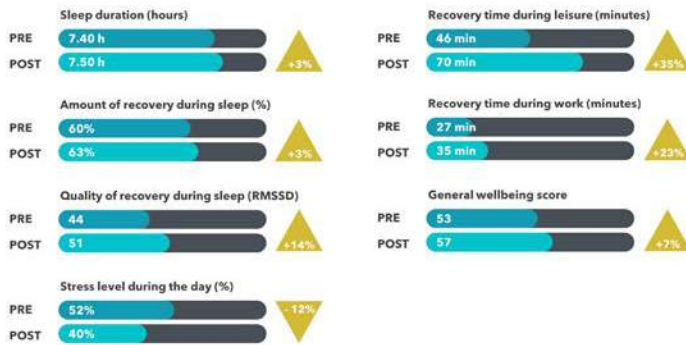


Fig. 1
Lifestyle Assessment comparison.
Pre-assessment (PRE) and post-assessment (POST) scores related to each component examined.
Credits: Francesca Bonetti & Giorgio Casoni.

Mindfulness Lab

The Mindfulness Lab uses experiential training to enhance people's work performance by decreasing their stress and anxiety levels through the exercise of mindfulness and attention via a digital platform and group coaching sessions. The extent of the intervention is also evaluated by reporting and comparing the results of questionnaires from the psychological literature, administered before and after the training. The Mindfulness training protocol primarily measures and trains one's own level of awareness, with a main effect on decreasing anxiety and stress. Cultivating one's own level of mindfulness is a valid method of training and mental well-being, as found in centuries of contemplative traditions and in recent neuroscientific experiments. The methodology adopted in the protocol administered through the digital platform consists of attention training on the present sensory experience, moment by moment, maintaining an attitude of conscious observation of the experiences and thoughts that spontaneously arise.

After the initial introductory workshop, all participants (73 employees of two major Italian companies) undertook the pre-assessment phase (computer-based), in which they provided answers on five questionnaires:

- Mindfulness Attention Awareness Scale (MAAS): it measures the mental presence of individuals, i.e. the general tendency to be attentive and aware of the present experience, moment by moment, in everyday life. The result consists of a unique score. If the score is low, this indicates a propensity to act as if on *automatic pilot*, or to be generically worried or anxious, without paying attention to the present moment. Conversely, a high score indicates emotional stability, a personality open to experiences, with emotional intelligence and a high level of well-being.
- State Anxiety Questionnaire: it measures the level of anxiety in the present moment, and therefore does not measure a personality trait, but rather a state of mind that can also vary from day to day, depending on daily events.
- Perceived Stress Questionnaire: this is the most widely used psychological questionnaire to measure the perception of

stress. It is a measure of the degree to which situations in one's life are assessed as stressful. The result concerns both the current stress level and the general perception of stress in one's life.

- **Emotional Style Assessment:** this questionnaire measures a person's resilience. Resilience is the ability to recover from adversities and difficult moments. If the score on this questionnaire is low, this indicates a propensity to remain in a negative emotional state following adversity. This score also indicates a high susceptibility in response to negative comments (feedback). A medium score, on the other hand, indicates intermediate resilience, characterized by a moderate persistence of negative emotions following adversity and moderate recovery. Finally, a high score indicates a very fast resilience following adverse situations, with a rapid return to a more positive mood. This score also indicates less reactivity to negative comments about one's way of being or operating.
- **Interpersonal Reactivity Index:** this questionnaire measures one's empathy skills on various aspects. Empathy is an individual's reaction to observing the experiences and emotions of others. In this questionnaire, empathy is seen as a multi-dimensional characteristic, which includes: the ability to take on another person's point of view (perspective taking), a key element in the development of social and interpersonal skills, but also an individual's reaction to observing the experiences and emotions of others (empathy). Both components are fundamental; if decisions are made without considering the other person's point of view, choices will certainly be biased, and execution plans may suffer substantial setbacks.

Once the pre-assessment was completed, the participants were invited to use Neocogita Brain Wellness platform and/or app following the indicated protocol of guided meditation sessions lasting 20 minutes each for at least 5 days a week. The types of meditation proposed within this protocol are:

- **Relaxation:** a technique that uses increased body awareness to improve people's ability to manage their own muscle relaxation.
- **Whole-body breath mindfulness (basic, intermediate, advanced level):** technique of focusing attention whose target is the breath and the way it moves the whole body.
- **Breath Mindfulness on the abdomen (basic, intermediate, advanced level):** Focusing attention technique whose target is the breath and the way it moves the abdomen.
- **Nostril breath mindfulness (basic, intermediate, advanced level):** attention focusing technique whose target is the breath and the way it flows through the nostrils.
- **Creativity:** intermediate technique between breath mindfulness and open monitoring, where the aim is to increase people's creative capacity.
- **Open monitoring:** technique in which the target of attention shifts from the breath to the space of the mind and its contents, such as images, thoughts, or emotions.

During the Mindfulness Lab, the audio-guided sessions were flanked by five in-person group coaching meetings, conducted at the companies by experienced and certified MBSR (Mindfulness Based Stress Reduction) coaches. During the meetings, the various types of meditation included in the audio-guided sessions were explored.

At the end of the Mindfulness protocol, the participants carried out the post-assessment phase, i.e. they provided answers to the five questionnaires used in the pre-assessment phase.

The average results below were obtained by comparing the scores obtained by each participant in the pre- and post-assessments. For each of the six components examined (presence of mind, anxiety, stress, perspective taking, resilience, empathy), a paired-samples t-test was conducted between the average scores obtained by the 73 subjects in the pre-assessment and post-assessment.

- Mental presence increased by 6% ($p < .001$),
- Anxiety decreased by 8% ($p < .001$),
- Stress decreased by 13% ($p < .001$),
- Perspective taking increased by 5% ($p < .001$),
- Resilience increased by 5% ($p = .006$).

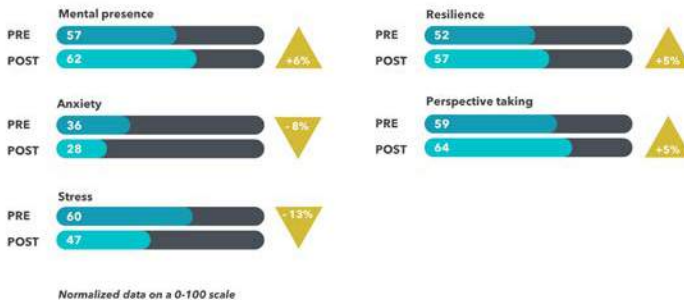


Fig. 2
Mindfulness comparison. Pre-assessment (PRE) and post-assessment (POST) scores related to each component examined. The difference between pre- and post-assessment is significant for all comparisons. Credits: Francesca Bonetti & Giorgio Casoni.

Cognitive Training Lab

The aim of the Cognitive Training Lab is to enhance people's work performance through the exercise of executive functions over a period of four weeks. To do this, computerized exercises via a digital platform for 20 minutes a day are carried out every day, supplemented by weekly group coaching sessions. The extent of the intervention is also evaluated by reporting and comparing the results of several executive function tests carried out before and after the training.

Innate talent and opportunity are important components of personal success, but several studies show that the ability most associated with good performance is 'grit'. Grit consists of the ability to focus on the achievement of goals, the ability to ignore distractions, the ability to organize one's time, short- and long-term planning, and all those mental processes that enable us to prefigure concrete scenarios for achieving goals. Executive functions are highly articulated and composed of various sub-functions, which work in synergy and are in any case associated with each other. The most important functions are:

- Working memory: Ability to store information in the short term and to perform operations on these memory contents.
- Cognitive control: Ability to regulate one's behavioral and cognitive response.

- Inhibition: Ability to block action with strategic purpose.
- Flexibility: Ability to move mentally from one concept to another quickly, or to reason about several concepts at once.
- Mental readiness: Speed of processing mental information (motor, perceptual and executive).
- Planning: Ability to prefigure and evaluate optimal courses of action to achieve goals.

After the initial introductory workshop, all participants (27 employees of a major Italian multinational company) performed 4 cognitive tests from scientific research that measure different aspects of cognitive functions:

- Working Memory Span. It consists of listening to a series of digits (starting with 2 digits and increasing by one digit with each correct trial) and typing them backwards.
- Stroop test. Test of executive functions. Consists of indicating the color in which the word is written, without being distracted by the meaning of the word itself (e.g. if the word GREEN is written with the color blue, one should indicate 'blue').
- Tower of London. This test consists of mentally planning a series of actions (specifically, moving the dots to arrive at the required configuration from the one given at the start of each trial) in as few moves as possible (i.e. in the number of moves indicated by the test).
- Simple reaction time test. It consists of touching the screen or pressing the space bar as fast as possible as soon as the target stimulus (a yellow square) appears.

Participants were invited to use the web platform and/or the Brain Wellness app following the protocol indicated on the different days. The protocol included the training of executive functions through N-Back and Go-No Go exercises.

N-Back is one of the most frequently used exercises for training working memory and increasing fluid intelligence. A sequence of stimuli (e.g., letters, figures, shapes) is presented and the person is asked to indicate when the current stimulus is the same as the one presented in the sequence in the previous n-position.

Go-No Go, on the other hand, trains reaction time, mental alertness and focus, as well as inhibition skills. A target figure is shown at the beginning of each session. The training consists of pressing the space bar (or touching the screen) as fast as possible when images other than the target figure are shown, and not pressing anything if the target figure is shown.

During the Cognitive Training Lab, the individual online activities were flanked by four in-person group coaching meetings, carried out to improve the skills learnt through the online exercises and further enhancing the participants' performance by fostering connections with the concrete reality of work experience.

At the end of the Cognitive Training protocol, participants carried out the post-assessment phase, i.e. they performed again the computerized exercises used in the pre-assessment phase.

The average results below were obtained by comparing the scores obtained by the 27 participants in the pre- and post-assessments. For each of the five components examined (speed, memory, control, automaticity, planning), a paired-samples t-test was conducted between the mean scores obtained by the 27 subjects in the pre- and post-assessment.

- Reaction time decreased by 4% ($p = .023$),
- Working memory increased by 14% ($p = .005$),
- Planning increased by 11% ($p < .001$),
- Control decreased by 14% ($p < .001$),
- Automaticity decreased by 11% ($p < .001$).



Fig. 3
Cognitive Training comparison. Pre-assessment (PRE) and post-assessment (POST) scores related to each component examined. The difference between pre- and post-assessment is significant for all comparisons. Credits: Francesca Bonetti & Giorgio Casoni.

Discussion

Today's society imposes on us working conditions that are increasingly difficult for our attention span. For some job categories, including managers, CEOs, leaders, it is now essential to always have technological devices such as smartphones and PCs within reach. But what impact does this have on our attention span? Destructive. Research (Stothart et al., 2015) has highlighted how receiving a notification or a call during a work activity where a certain amount of concentration is required, has a negative impact on what we are doing, as receiving notifications significantly impairs performance in an attentional task even when participants have not directly interacted with the device from which it was emitted. Thus, it is enough to know that we have received a notification to impair our capacity for focused and sustained attention.

Neocogita Brain Wellness program is extremely helpful in counteracting this condition. Mindfulness, for example, is a crucial practice, as through meditation it makes us more and more aware of the ongoing shift in attention and teaches us to bring our attention back to our target faster and more effectively. The results obtained confirm its effectiveness in increasing overall well-being, even in a corporate context. The significant reduction in stress and anxiety, associated with an increase in determining components such as focused and sustained attention, awareness, resilience, and mental presence, makes meditation a very powerful tool for increasing one's performance at work and beyond.

At the same time, cognitive training is also a valuable ally for enhancing attentional skills. One of the main characteristics that makes our brain an extremely fascinating organ is brain plasticity. By exploiting this peculiarity, the brain is able to reorganize its functionality according to the environmental demands to which

it is constantly subjected or as a result of learning processes. Brain plasticity, or neuroplasticity, means that the brain, just like all the muscles in our body, can be trained through assiduous and targeted practice. Just as training the muscle structure allows us to increase our strength and achieve greater physical performance, training the brain allows us to increase our cognitive abilities, both at work and in everyday life. The results showed how cognitive training over a four-week period, using carefully selected and targeted exercises, enhanced the participants' executive functions, i.e. those skills that are indispensable for coping optimally with constant problems that require us to find more or less complex solutions (problem solving).

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Data Driven Design: From Environment to the Human Body

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Abstract

Based on doctoral research developments, the paper presents an analysis of how the use of Artificial Intelligence technologies and Data Driven Design can be the key to activating sustainable design actions that have positive impacts on the human body and communities. First we will distinguish how technology can be beneficial, in two macro cases, whether placed within the design or in the product/service itself. This will be followed by an analysis of the types of spillovers based on spatial/temporal factors and types of implementation. Research still under development focuses on comparison of case studies and analysis of literature sources. A subsequent prototyping and testing phase is planned to test whether what is hypothesised in the current phase is tangible and to what extent the effects are controllable.

Keywords

Artificial intelligence
Design process
Well-being
Sustainability

Introduction

Artificial intelligence (AI) is considered, by experts and researchers (Google, 2021; Kahneman et al., 2021), to be a tool to automate a task, and useful in increasing a person's ability to perform that task alone, faster and more efficiently. For this reason, artificial intelligence can both help the end user with choices and actions and help simplify, automate, and augment the design process.

For the Ellen Macarthur Foundation (2022), designers working with AI can create products, components and materials suitable for the circular economy. AI can offer a more informed view of the most effective designs to create and test to make the best use of their time and skills.

Artificial intelligence can be used generally for:

- Inform and accelerate efforts to design out waste and pollution
- Increase the effectiveness of and optimise circular economy business models
- Streamline the infrastructure needed to keep products and materials in use
- and AI able to do it through the analysis of large amounts of well labelled data, such as material databases, consumer preference data, and sifting through countless designs and suggesting the ones which best circular design criteria.

If the goal is sustainability of products and services, technologies within the design process are useful if they are built to indicate constraints and parameters, to define design choices that will lead to achieving that purpose (Uçar et al., 2020). Sustainability is an issue of high complexity (Ghisellini et al., 2016), which is why it becomes increasingly necessary to take advantage of the technological features (Bressanelli et al., 2018) mentioned earlier.

Bringing together large amounts of data to provide both insights at an early stage conditions and rules during design development allows for more responsible design (Bihanic, 2016). It allows one to maintain an overall picture while having the ability to delve into the detail of an individual project component (Golinska et al., 2015).

In summary the use of artificial intelligence technology (Nazioni Unite, 2022; European Commission, 2022; European Commission, 2020), based on the collection and processing of data, allows the analysis of the entire life cycle of products (from the processes of conception and production, to those of the conclusion of the first lifetime and the start of new cycles) and for this reason it allows designers to control the management and usability of articulated systems of knowledge. As a consequence, the figure of the designer can act as a coordinator of a complex design process between stakeholders who have different technological knowledge and the use of tools that monitor the behaviours of the community in order to generate human-centred innovation processes that include both the level of techno-science and social innovation (Manzini & Vezzoli, 2002).

Methodology and stages of research

To assess the actual impact of artificial intelligence for the well-being of the individual and the community (Celaschi, 2017), the research is divided into stages subsequently described. Based on a multidisciplinary review of the existing literature, the work included an analysis of the relationship between implemented sustainable measures and the positive response of the community and in particular the psychological and physical well-being of the people involved. The purpose of the study is to establish an initial framework, to reason about what are the right implementation practices and how they are structured, to achieve sustainable outcomes while positively affecting people's health.

Therefore, this paper answers the questions: how could AI technologies support sustainable artefacts or project development? What factors influence the relationship between sustainable projects and effects on human well-being?

With the research questions in mind, the study identified two main roles of artificial intelligence, static and autonomous (Frank, 2021), and based on this identified several correlations between sustainability and well-being. These relationships are to be explored further in the following section: Case Studies and Preliminary Analysis.

The current research phase also involves active discussion with international research centers and leading companies. This is in order to be able to study design processes that operate with environmental respect, to understand how technologies (and the data that enable them to work) are structured and how designers relate to them. This will serve to better detail the research hypotheses and prototype an AI, with a reduced scope, to be integrated into some design processes. This will be done to test how this interaction occurs at all stages of the design process and what effects it has on both the ecosystem, the social environment, and individual users.

A capillary focus will include an analysis of how user participation in content and information generation serves the implementation of intangible platforms related to products and services (Li & Voegelé, 2017). This will be followed by an examination of that process in order to elaborate new user-artefact interactions and ascertain what parameters can generate solutions that converge toward broader social and environmental sustainability.

Artificial intelligence and Data Driven Design

Two macro-cases of AI use can be distinguished, one static and one autonomous (Frank, 2021). In the first case, the technology is used conventionally, and the magnitude of environmental benefits is determined by the design, production, and distribution of products pre-purchase, and therefore no longer editable. Autonomous environmental benefits result from autonomous post-purchase interactions between an AI-enhanced product and its environment, which include learning and decision-making. Product services that use artificial intelligence and are connected to the Internet (IoT) have a continuous interconnection between product, user and database,

which involves constant deployment, and can be investigated as information-experiential hybridization to quantify and qualify the impacts these artefacts have on human behaviour (Zannoni, 2018).

Having AI and machine learning (ML) technologies embedded in the product/service allows for greater and continuous control by the design team. For that matter assiduous implementation of the user experience that improves the quality of the artefact and actual and perceived well-being.

The well-being effect that results from these implementations can be achieved with relative ease and speed, as the design and results of these design choices can be implemented and measured in a very short time frame (Bressanelli et al., 2018). Where autonomous technology is used, the design process is cyclical and tight. If, on the other hand, AI technology is only integrated into the design process for the purpose of developing sustainable products/services, the positive impacts on the community and individuals may vary in timing as the effects may not be as closely related temporally. As a result, some benefits of sustainable artefacts are not immediate. Therefore, this temporal factor was analysed, which is useful in understanding the relationship between technology, sustainability, and well-being.

Case studies and preliminary analysis

From the literature reviewed sustainable projects and implementations have positive effects on the well-being of individuals and the community, but how are these factors correlated? Therefore it is important to point out that most sustainability indicators ignore well-being and vice versa. An example of the former is the *World Bank's Genuine Savings (GS) Index*, while the *United Nations Development Programme's Human Development Index (UNDP and HDI)* is characteristic of the latter (Neumayer, 2007). So, if it is quite evident that there is a correlation between sustainability and well-being when does the latter manifest itself as a function of the former?

From a preliminary study, positive spillovers can be schematised according to the timing of impact, namely the time it takes to have a real effect on people's health. Of all the case studies examined, it was decided to show four illustrative examples, with different combinations in terms of AI use and timing, to be able to argue the considerations that emerged from the analysis. The table below shows the four case studies.

The case studies were retrieved from the webpage *Artificial Intelligence And The Circular Economy* (archive.ellenmacarthurfoundation.org), and from the sites mentioned in the footnotes. The table [tab 1] relates whether and how the technology is used, what type of implementation it is, the timeframe it takes for the positive effect on people's health to manifest itself, and whether this effect is only reflected in the users or is it an extended community well-being.

CASE STUDY	TECHNOLOGIES	STATIC	AUTONOMOUS	IMPLEMENTATION	IMPROVEMENT OVER TIME	EFFECT	TIMING	TYPE OF EFFECT
Philips CityTouch ¹	IoT, RFID, data analytics		x	Energy saving, light distribution	Continuous	Direct to user	Short-term	Security, psychological well-being
ZenRobotics ²	Robotics, artificial intelligence		x	Recycling	Continuous	Extended to community	Long-term	Physical health, well-being
ACCMET ³	Artificial intelligence	x		Rapid and systematic development, non-toxic metals	Does not change	Direct to user	Short-term	Physical health
MOTIVO ⁴	Artificial intelligence, data analytics	x		Chip design process	Does not change	Extended to community	Long-term	Well-being

The first case study concerns *Philips' CityTouch* model providing intelligent street lighting services. It extends the usage phase of streetlights and increases efficiency in public energy consumption. It provides an IoT (Internet of Things) platform for lighting management to which individual lampposts are connected via an RFID (Radio Frequency Identification) network. The sustainable impact occurs because the model allows the light intensity to be changed remotely according to daylight and street conditions. In addition, bulbs have to be replaced according to actual burning hours (Morlet et al., 2016). The improved visibility conditions increase the safety of drivers and those living near roads where these lighting systems are installed. Given these parameters, there is an immediate feel-good effect that is prolonged over time because it is always technologically up to date.

ZenRobotics combines robots and artificial intelligence to recover recyclables from waste. The *ZenBrain* software, through the reprocessing of visual data provided by cameras and sensors, is able to increase the recovery rate and purity of secondary materials. The technology allows for a continuous improvement in performance, but the effects related to sustainability and well-being are not immediate and are difficult to perceive by the population (Ottman, 2017).

The EU-funded *ACCMET* project (Accelerated metallurgy - The accelerated discovery of alloy formulations using combinatorial principles) was launched to accelerate the process of alloy identification. Using advanced algorithms, all the information collected is stored in a virtual library in order to identify properties, composition, structure and processing parameters and predict the properties of new compositions.

The focus on environmentally friendly alloys at an early design stage, in combination with life cycle analysis, helps to conserve natural resources and assists the move towards low-carbon technologies. One consequence of designing with the principles of the circular economy in mind is that the designed alloys will be non-toxic, and thus have an immediate impact on the health of the population.

The company *Motivo*, from San Francisco, develops artificial intelligence and machine learning solutions for chip design

Tab. I

The table shows research and business projects that have been developed with AI or are being implemented thanks to AI. The projects were retrieved from the ellenmacarthurfoundation.org

- 1 www.lighting.philips.com
- 2 www.terex.com/zenrobotics
- 3 cordis.europa.eu/project/id/263206
- 4 motivo.ai

analysis and optimisation. Thanks to its tools, semiconductor companies have been able to reduce the costs of design and test iterations. In two pilot projects, it was demonstrated that the tool can reduce semiconductor design processes from several years to a few weeks. This results in reduced costs, increased reliability and yield, improved quality and faster time to market. In this case, the improved utilisation of resources generates a welfare that can be demonstrated in the long term. While the economic well-being generated by *Motivo* can be manifested in the immediate term, the improvement in health develops as the waste of materials (silicon) decreases, and as they are used more correctly. For these reasons, the latter is complex to calculate.

In summary, the following close correlations can be deduced from these examples in the table above: The first is that the implications regarding improvement over time are due to how the technology is used, whether static or autonomous. The second concerns the time of impact with respect to who is affected by the effect, whether it concerns the user or is extended to the community. Thirdly, the type of implementation is then reflected in the type of positive effect.

Final considerations and future developments

As previously described, it can be inferred from the case studies that when technologies are integrated into the project there is a continuous improvement in well-being because there is an autonomous and continuous implementation. One observation needs to be made explicit, namely that the continuous increase can occur even when there is a use of AI in the design phase alone, but this increase is due to the extension of the project's area of deployment and the enlargement of the pool of users involved in the use of those artefacts. Not because of an increase in those artefacts already produced, but only because of the continuous improvement of the design that will bring improvements in future artefacts.

One piece of evidence that emerges from the table is that the closer the product/service is to the body (spatial proximity) of individual users, the more immediate and explicit the impact on wellbeing (temporal proximity). Regarding timing of the implementation of the beneficial effects is concerned, short timeframes are therefore expected for projects that directly involve users, while long timeframes are expected for projects that focus on environmental sustainability.

These factors and their correlations will be useful at a later stage as parameters for outlining how AI can be integrated into design and products. What is the possible impact of the technologies both ecologically and in terms of people's well-being? What is the most effective and fastest way for these impacts to occur? Given these preliminary considerations, a precise scope of investigation will be defined, i.e. a choice will be made as to which of the design phases to implement. This focus will make it possible to deepen the research and produce a prototype in a shorter time. This prototype will be realised in collaboration with the partner company of the PhD project and will be a machine learning system based on ISO stand-

ards and European guidelines (European Commission, 2020; 2022). Subsequently, there will be an autonomous implementation phase of the prototype, which will be used during the design of a previously chosen product/service. It will proceed in an iterative manner by testing and improving system bugs. After this phase, it is of interest to research how the specific solution found can be adapted to other aspects of the artefact, and to other design phases.

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(Re)Active Materials. Well-Being's Concept Evolution and Advanced Material Innovations

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Abstract

The article aims to read the transition of material design approaches identifying an evolutive models with major principles and contribution into the health improvement through material innovations. The analysis follows a bottom-up approach, using a case-based reasoning methodology to study well-being concept evolution and identify new material experimentations frontiers within three approaches: *Imitative*, *Augmentative*, and *Mutational*. The contribution of the article reflects and suggests the introduction of new material design approaches to manage the design of advanced materials' behaviours in their future development, highlighting their potential impact on user satisfaction and acceptance, collective welfare improvement, performance optimization, and environmental concerns.

Keywords

Advanced materials
Performative materials
Hybrid processes
Interdisciplinary research
Material design

Introduction

“Understanding the interaction between the individual and the systems / objects that surround him [...] is fundamental to carry out projects “on a human scale” (*Sicklinger, 2010, p. 223*).

In the last 50 years, technological progress and the change in economic conditions have fueled a (un)balanced global prosperity. In today's society, there is a growing need to overcome established standards and models that are no longer working (United Nations, 2015), imagining new ways of prospering without compromising future developments (WCED, 1987). The future must be interactive and smart (Ferrara et al., 2018), and advanced materials are crucial in enhancing human conditions. Through an interdisciplinary approach, innovative technology can be integrated into advanced materials fostering a more sustainable and symbiotic relationship between the environment and matter for the well-being of individuals and communities (Tosi & Rinaldi, 2015). This analysis aims to read the transition of material design approaches, identifying evolutive models with major principles and contributions to health improvement through material innovations. The contribution reflects on and suggests new material design approaches to managing the design of advanced materials' behaviours in their future development. The article discusses three approaches (*imitation, augmentation, and mutation*) by providing case examples.

Behavioural materials

Technological progress has offered to innovate materials and conceive tools to address human needs for progress (Ashby & Johnson, 2010), improving the performance and quantity of newly available substances over time. These rapid advancements enable flexible and intelligent materials – with programmable properties (Oxman, 2010a; 2010b; Gilbert & Ellis, 2019) – to achieve versatile abilities and organic growth, too (Langella & Santulli, 2017). The increase in the significance of innovation studies in various fields contributes to designing upgradable and performative materials' behaviours, overcoming human limits and narrowing the relationship between individuals' and artefacts' surfaces. The alteration of materials has led to evolution from a general characterization of mechanical, physical, thermal, electrical, and chemical performances (Cornish, 1992; Ashby & Johnson, 2010) to wholly controlled and more sensitive properties (Ferrara, 2016; De Giorgi et al., 2020; Lerma et al., 2022). Following this progress, increasingly eco-efficient strategies inspired by natural resilience are spreading and exploring transversal properties and realms linked to the *Material Experience* (Karana et al., 2015). Biological resilience and natural efficiency have once again become good quality indicators (McDonough & Braungart, 2002; Franklin & Till, 2018), stimulating designers and manufacturers to refer to this pool of resources to develop consistent alternative solutions.

In ancient society, well-being was often equated with wealth, power, and material possessions representing unsustainable patterns. Over time, the concept of wellness has evolved (Vezzoli & Manzini, 2007), and a holistic perspective has been advocated in contrast with past values and assumptions (Ceschin & Gaziulusoy, 2016). The human factors, as a part of a complex ecosystem, have become the focus of current design practices (Germak, 2008), with a growing emphasis on mental health, emotional well-being and evolution of wellness in equilibrium with contexts, ethics, and cultural aspects (Tamborini, 2009). Despite scientific and technological ameliorations, new development is still necessary to meet evolving needs (Tamborini, 2009), given the rapid expansion of the population. Multidisciplinary collaborations and systemic approaches are achieving centrality in pursuing sustainable strategies of development to address societal challenges (Ceschin & Gaziulusoy, 2016). In that sense, the article highlights the crucial role of design in promoting interdisciplinary exchange between technical-scientific and social-humanistic disciplines to re-design sensitive, augmented, and experimental solutions towards new human experiences of the world.

However, the design of a balanced relationship between individuals' needs and external ecosystems remains a significant challenge for design practitioners in fostering a shared ethic of care for all beings (Tosi & Rinaldi, 2015) and all the systems involved. Some interesting case studies differing in terms of goal and time can be read crosswise to intercept connections from a design point of view to understand how the well-being concept has evolved around specific methodologies.

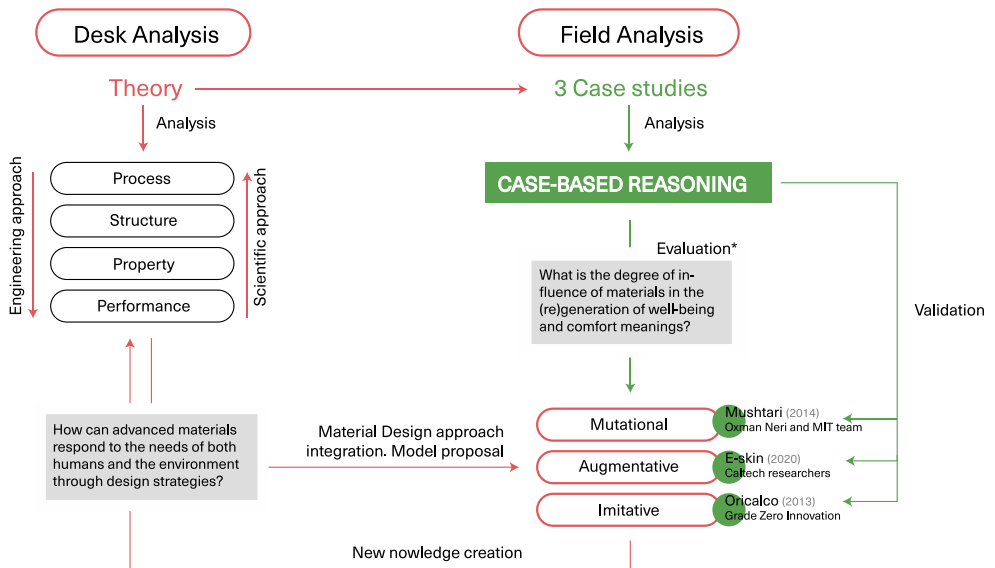
The article intends to answer these questions: How can advanced materials respond to the needs of both humans and the environment through design strategies? What is the degree of influence of materials in the (re)generation of well-being and comfort meanings? The influence of materials on the human experience below three approaches interpreted from the literature analysis: *Imitation*, *Augmented*, and *Mutational*, have been discussed and analyzed in the following sections.

Materials and method

According to the literature, the article proposes an ongoing development study focusing on material design approaches that can be integrated into the engineering and scientific ones (Olson, 1997) towards a shift of focus on a more symbiotic relationship between humans and matter. The analysis follows a bottom-up approach using case-based reasoning methodology (Zambelli, 2022) to study the well-being evolution explained through three material innovation examples Fig. 1. The article introduces three hypothetical approaches interpreted by authors both from the literature review analysis and case study observation, which symbolize the degree of material influence on human perceptive experiences. The goal is to read an evolutive transition in material design approaches for the health improvement towards new strategic ways to manage the design of advanced mate-

rials' behaviours. The first section focuses on imitative practices that draw inspiration from natural models and biological mechanisms to design efficient artefacts – known as mimicry design (Benyus, 1997; Langella, 2019). The second concerns augmented systems utilizing advanced technologies to expand human sensory limits and provide more sensitive solutions integrating intangible features (Ferrara et al., 2018). The last section advocates for a shift in design priorities through foresight advances in materials hybridization, as the pioneer Oxman (2013) pointed out, by exploring speculative scenarios with high technological development where the integration of living and evolving materials can optimize human bodies.

Cases' strategies have been explicated to highlight principles and effectiveness in the problem-solving approaches proposed. Finally, the methods have been summarized to open a discussion and promote further research areas of inquiry.



* Through case studies the new approaches proposed have been explored, explicating their contribution in the well-being improvement

Imitative approach

The assumption of natural models for design inspiration has ancient origins. It focuses on the biological problems related to the life of natural organisms (Langella & Santulli, 2017), whose evolution offers correspondences and analogies with modern industrial processes. Nature offers an inexhaustible source of design inspiration, providing models of efficient biological mechanisms that can be reproduced in artefacts through *imitative* approaches (Salvia et al., 2009; Bengisu & Ferrara, 2014; Franklin & Till, 2018). Technological and scientific advancements have led to hybrid materials with complex structures, properties, and behaviours that can be programmed on microscopic and nanometric levels to respond to specific problems and design needs (Langella, 2007). *Oricalco* by Grade Zero Innovation (Grado

Fig. 1
The cycle of the research analysis. Credits: Author.

Zero Innovation, n.d.; Langella, 2019), a thermosensitive smart shirt, is an example of a self-adaptive garment inspired by biological adaptation mechanisms to extreme climatic conditions. Thanks to the super-elasticity of shape memory metal alloy, the controlled alteration of materials' shape (sleeves) to external variations (temperature) improves the efficiency of ordinary artefacts, making them capable of exchanging forms of energy with the external environment (Salvia et al., 2009) and provoking active performances. Material advances through *imitative* strategies have led to the following:

- Draw from ecosystems' functional, engineering, chemical and electrical solutions (Langella, 2019).
- Actively modelling hybrid matter
- More effective properties and behaviours.
- Microscopic and nanometric manipulation towards wider needs (Langella, 2007).

Augmentative approach

In addition to the manipulation of the material – as seen previously with the *Oricalco* project – advanced technologies allow expanding the human sensorial limits, providing designers with more sensitive solutions and tools (Lerma et al., 2022) and performing multiple activities – monitoring, communicating, stimulating, and so on (Tosi & Rinaldi, 2015). Thanks to miniaturization, augmented materials are slightly introducing multi-sensorial characterization in artefacts which can meaningfully affect the emotions and interactions of individuals. The California Institute of Technology (Caltech) and the Graduate School of Engineering in Japan are international research centres experimenting with *E-skins* devices with flexible electronic biosensors. Their researches reveal the exciting development of artefacts with capabilities of self-regenerate and self-feed¹ (Yu et al., 2020). From robotics to the health care of physical disabilities – assisting in simple contact without the request of specialized experts – intelligent materials may supplement human capacities. However, challenges remain in terms of power, for example, fueling directly by human bodies interference, without comfort loss, and using sustainable resources due to unrenovable, rare and critical materials involved (Zou, 2018). The major contributes of this approach to well-being improvement are:

- The possibility to collect and analyze personal health conditions remotely.
- Collection of data for customized, effective intervention
- Accuracy prediction mechanism for diseases' detection and treatments (Tosi & Rinaldi, 2015).

1

The cathode of the E-skin's biofuel cell is composed of a network of carbon nanotubes coated with nanoparticles containing platinum and cobalt. The anode is a nanocomposite material containing an enzyme capable of breaking down the lactic acid of sweat, which is processed to power the system.

Defined by the Nobel Prize physicist and chemist Ilya Prigogine about the mechanisms that are part of complex systems in the study of thermodynamics. These systems can maintain their structure and growth, evolving through an entropic exchange with the external environment.

The last section focuses on “next” materials in which genetic mutation responds to human needs in speculative scenarios with high technological development (Ferrara, 2004). It is referred to ageing and living materials which can offer solutions that intersect and shape an indefinite and fluid future (Oxman, 2010a). Such performative materials can be integrated into the human body, like living extensions, changing its physical and chemical processes according to the new scenarios. The Material Ecology theory and the *Wanderers project* by Neri Oxman (2014) triggered designers to become alchemists and experiment with alive materials through the cross-fertilization between built, grown, and augmented matter (Oxman, 2013). The wearable device project represents an artificial exoskeleton generative designed to perform an artificial anisotropy (Oxman, 2010b), and it is filled with living and evolving matter – bacteria selected to perform functions like absorbing nutrients, digesting biomass and generating energy. Concerning synthetic solutions based on natural processes and biological systems, new research frontiers overcome “terrestrial” barriers and try to break down traditional canons of design practices towards:

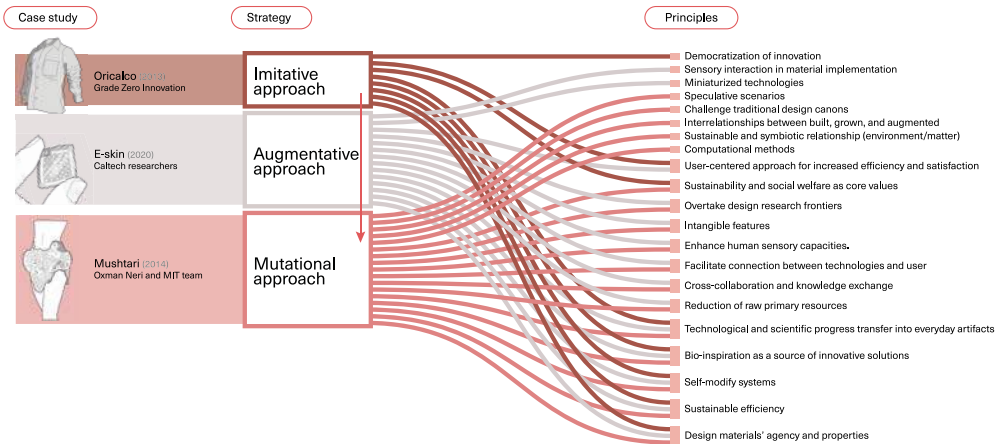
- Define future matter identity (Oxman, 2013)
- The study of material's performative capacity to optimize human bodies
- The analysis of reciprocal mutations between synthetic biological systems and individuals.
- Advancing in mutation metrics and control.

Results

The assumption of *Imitative, Augmentative and Mutational* approaches aims to encourage design practitioners to (re)consider fundamental archetype models (Ferrara, 2016; Franklin & Till, 2018) related to the capacity of biological entities to evolve and adapt in different contexts based on open systems² procedures (Mancini, 2018). Integrating new approaches in material design practices involves primarily drawing inspiration from nature at different levels of technologization to convey material innovations towards social welfare needs no less than environmental requirements. As virtuality and physicality slightly left products, designers focus on the cultural significance and sensorial aspects to create more adaptive and responsive environments (Ferrara, 2016).

Concerning the models proposed, Fig. 2 shows set of principles assumed by case studies processes analysis. Case study principles have been developed from the comparison between other cases' theory and goals to support provocative interpretations (Cunningham, 1997). The variables highlighted in the figure depict the efficiency, technological advancement, interdisciplinary design approaches, and sustainability, as prioritized principles among others due to their multiple connection with all the strategies involved. In particular, a relevant insight come from bio-inspiration and user-centred methods, such as core values in driving technological and scientific progress that transfers into everyday artefacts,

implementing new intangible features thanks to sensory interaction and self-modify systems. Moreover, experimental projects like Wanderers make it possible to visualize alternative preferred scenarios, offering concrete directions and strategies to work on. In that sense, the design mediation between advanced technologies, speculative projects and users is essential to facilitate the democratization and dissemination of innovative research discoveries, supporting the scale-up of ideas from laboratory experimentation to mature and appreciated forms. By facilitating the connection between technologies and users, designers can create systems that enhance human sensory capacities and promote broader social welfare in terms of space and time. The principles identified through case studies seek to overtake design research frontiers and challenge its traditional canons, stimulating designers to shape the agency and properties of materials in unprecedented ways. However, due to the growing complexity of cross-contamination and merging realms, interdisciplinary collaboration is essential to manage appropriately and shape materials' behaviours, achieving sustainable efficiency.



Conclusion

The analysis identifies innovative nature-based material design approaches to optimize the performance of artefacts towards future scenarios and needs. The combination of nature's wisdom and efficiency allows designers to read in the complexity a generative opportunity for a redefinition of the concept of well-being and creating emotional and (intrinsically) more sustainable experiences. The article shows how advanced materials have expanded the boundaries of design towards the hybridization of entities, fields, and systems, allowing them to react to changes and respond to human and environmental needs with higher sensitivity. As highlighted, design practices are crucial in developing open systems of experiences, supporting collective welfare, optimizing the artefacts' performance, extending the sensory limits of the human body, and addressing new environmental concerns. The evolving models of material design, including *Imitative*, *Augmentative*, and *Mutational* approaches, have

Fig. 2
The case-based reasoning analysis and the principles extrapolated. Credits: Author.

shown significant contributions in addressing societal challenges. Due to the assumption of new approaches, further studies may focus on the following:

- Promoting a symbiotic relationship between humans and the environment
- Identifying new needs and challenges
- Exploring these material design approaches and their potential to address societal challenges and advance well-being.

According to Oxman (2013), the rise of new materiality can establish symbiotic extra-deep interconnection between humans' and artefacts' skins, emphasizing values not directly tangible with senses and influencing – or changing – the way of conceiving the world. Advanced, synthetic, and organic hybrid resources profoundly affect well-being meanings establishing new forms of comfort, caring and adaptation. New forms of material behaviours (Cardillo & Ferrara, 2008), increasingly performative, living and ageing – as they have their own agency and emotional experiences – led to generate more sensitive artificial entities with effective reactions. However, restoring the ethical responsibility that will play a crucial role in designing intangible attributes embedded into them (influencing feelings and emotions) and in planning new sustainable conditions suitable for the life of both natural and artificial systems is fundamental.

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NEW MATERIAL DESIGN APPROACHES FOR THE WELL-BEING IMPROVEMENT

Strategic objective	Assuming natural models to improve the efficiency of artefacts provoking active performances.	Expanding the human sensorial limits, providing designers with more sensitive solutions and tools and performing multiple activities	Materials with genetic mutation integrated into the human body like living extensions, changing its physical and chemical processes
Perspective	Draw from ecosystems functional, engineering, and even chemical and electrical solutions	Develop intelligent materials to supplement human capacities	Analyze reciprocal mutations between synthetic biological systems and individuals
Key activities	- Mimicry research - Product design	- Remotely analysis - Product design - Health treatments	- Speculative research - Symbiotic systems design
Main challenge	Microscopic and nanometric manipulation towards wider needs	Collect data to foresigh and predict diseases' detection and treatments	Advancing in mutation metrics and control to optimize human bodies
	Imitative approach	Augmentative approach	Mutational approach

SUITABLE AND SUSTAINABLE CONDITIONS FOR THE LIFE OF BOTH NATURAL AND ARTIFICIAL SYSTEMS

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Fig. 3
 New approaches for well-being improvement and evolution of Material Design practices. Credits: Author.

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PASSO Project: Design of a Smart System Using Biofeedback to Train People with Parkinson's Disease

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Abstract

This paper describes the design process of a smart system monitoring and training the gait and posture of people with Parkinson's disease. The project aimed to develop an innovative mHealth system and validate it in a laboratory context. The designed solution is supposed to help people in postponing the rise of the most impairing symptoms and prolong autonomy. The project was divided into three main design cycles regarding respectively the design and test of sensory signals, the smart wearable devices transmitting them, and the system interface.

The multidisciplinary team involved in the project followed a User-Centered methodology, involving users in the design process to improve the system's usability and accessibility.

The adopted methodological strategy led to satisfactory results and proved to be particularly suitable for multidisciplinary design processes involving both human and technological factors related to the development of smart systems targeted to niche users.

Keywords

User-centered design
Smart device
mHealth system
Sensory feedback

Introduction

The supplementing between digital technologies and wearable objects produces a new performance level for the human body, able to modify the relationship with the environment to improve the execution of daily life activities (Dall'Osso, 2021).

Wearable smart objects, intended as physical, visual, or virtual prostheses, are characterized by a consistent level of complexity demanding a multidisciplinary contribution from different sciences to develop efficient design research projects (Zannoni et al., 2021).

Thanks to the Internet of Things and Artificial Intelligence, it is now possible to design wearables supporting and empowering the human body to increase motor and cognitive abilities. Data detection, elaboration, and interpretation can suggest behaviors to improve performances and, in general, health and well-being (Tosi & Rinaldi, 2015).

Smart objects can detect the person's habits and autonomously adapt themselves to satisfy the personal needs of a disadvantaged category of users. This new scenario allows imagining possible solutions to sustain and prolong the autonomy of people with specific disturbances in the environments they are used to living in. People affected by motor impairments can take great advantage of emerging technologies correcting postural behaviors, by improving movements and postures and, consequently, decreasing their need for personal assistance for daily life tasks (Imbesi, Mincoelli et al., 2021).

This paper describes the design process for the development of a smart system monitoring and training the gait and posture of people with Parkinson's Disease (PD), aiming to postpone the rise of the most impairing symptoms and to prolong the person's autonomy. The project is related to a research agreement between the Department of Architecture of the Università di Ferrara and the Department of Electrical, Electronic, and Information Engineering of Bologna, both in Italy.

PD is classified as a degenerative neurologic disorder related to Dementia, resulting in several motor impairments related to the gait as akinesia (difficulty in starting the movement), bradykinesia (slow movements), rigidity, postural instabilities, tremors (rhythmic movements in a resting position), and events of freezing of gait (unexpected short immobility) (Reich & Savitt, 2019). Together with these limitations, there is an increase in the falling risk and a general decrease in the person's quality of life, starting to need personal assistance for activities of their daily routine.

Physical exercise and physiotherapy impact PD motor impairments by decelerating motor decline (Sweeney et al., 2019). Moreover, motor training effects can take advantage of increasing cognitive engagement thanks to the submission of cueing or biofeedback in PD (Davis, 2018). Cueing consists of temporal or spatial sensory stimuli that ameliorate and facilitate repetitive movements by providing an explicit motor target (Ayena et al., 2017).

Project PASSO

The PASSO (PArkinson Smart Sensory-cues for Older-users) project (“Cues”, 2021) aims to develop an innovative biofeedback system specifically designed to monitor and rehabilitate gait and postural impairments in people affected by PD, during specific training sessions in the domestic and ambulatory environment.

The system is targeted to PD subjects facing the initial and intermediate stages of the disease, dealing with some physical ailments affecting walking and motor skills, consequently creating an unfavorable effect on physical independence and well-being (Gibb & Lees, 1988; Kalia & Lang, 2015). It aims to support PD people in performing tasks and giving a most satisfying, efficient, and user-friendly experience.

The PASSO project involved a multidisciplinary team formed by researchers expert in design, biomedical engineering, Computer Science, and technology, following an iterative User Centered methodology. User-Centered Design (UCD) was considered an appropriate approach for this project that aims to improve the quality of life of self-sufficient older people with PD in safety, independence, and autonomy in domestic and ambulatory environments. Moreover, the UCD approach consented not to be focused only on primary users, but also to support the other users and stakeholders who could have a relationship with the developed system (Imbesi, Mincoletti, et al., 2021; Imbesi & Mincoletti, 2020; Mincoletti, 2008).

The first category of users considered in the project was persons with PD but also medical operators (neurology, physiatry, and physiotherapy) and technical operators (design, bioengineering, computer science, technology, informatics) were involved. The design process involved almost twenty users: the primary ones, identified as people affected by PD, were from 60 to 70 years old, facing the initial stages of the disease, and not presenting comorbidities.

The involvement of users in the design process wanted to improve the system’s usability, allowing people to take advantage of a satisfying experience that will help them to better deal with specific activities of their life (Imbesi & Scataglini, 2021).

The design process was split into three main parts, identified as a singular iterative cycle of the project. Specifically, the first cycle was about sensory stimulations and the system submitting them, the second design cycle regarded devices submitting sensory feedback, and the last aimed to develop the system’s interface for the users. Each design cycle was then separated into four interrelated phases: planning, analyzing, creating, and verifying (User-Centered Design Process Map, 2013).

Visual, acoustic, and haptic stimulations

The first design cycle analyzed which kinds of images, sounds, and vibrations more influence users’ spatiotemporal gait parameters, and which induce immediate reactions without stressing the person.

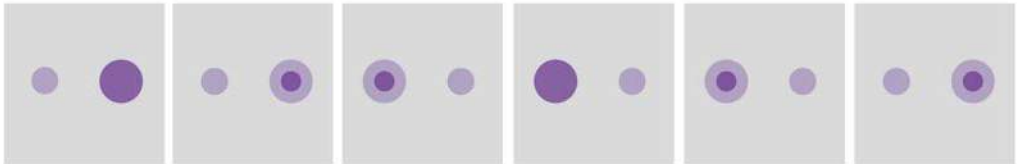
Designed cues typologies were related to different sensory channels: the visual stimulus was submitted to the user through Smart Glasses (SG), the acoustic stimulus was provided through

traditional wireless earphones and, finally, the haptic one was transmitted through the temples of SG.

The mHealth system submitting sensory cues was composed of inertial sensors positioned on the person's body, an Android Smartphone App using algorithms to compute posture and gait features, and an Android SG App generating visual and haptic biofeedback.

All designed cues did not represent or pronounce the suggested action but conversely tried to induce it with simple and intuitive communication, not requiring a cognitive or interpretative effort from the user Fig. 1.

Several mono-sensory and multi-sensory cues were tested to collect



information about users' physical and emotional responses. Users participated in a testing protocol, where they were asked to walk along a path while receiving sensory feedback and to adapt their gait to the suggested cadence.

Qualitative information was obtained from an individual interview and a short questionnaire submitted to users while testing the signals. The investigated aspects were perceived difficulty in following the signal and perceived invasiveness and annoyance. On the other side, quantitative information was collected by monitoring users' gait spatiotemporal parameters like the difference between the user's cadence and the target one, the number of steps to reach the target cadence, user's cadence variability, rhythmic asymmetry, etc. Fig. 2.

Fig. 1 PASSO, visual feedback prototype. The image represents the prototype of visual feedback projected on the SG lens. It is composed of six photograms simulating a symmetrical oscillation that, synchronized with the personal gait rhythm, should suggest a regular walk to the user. Credits: Silvia Imbesi.

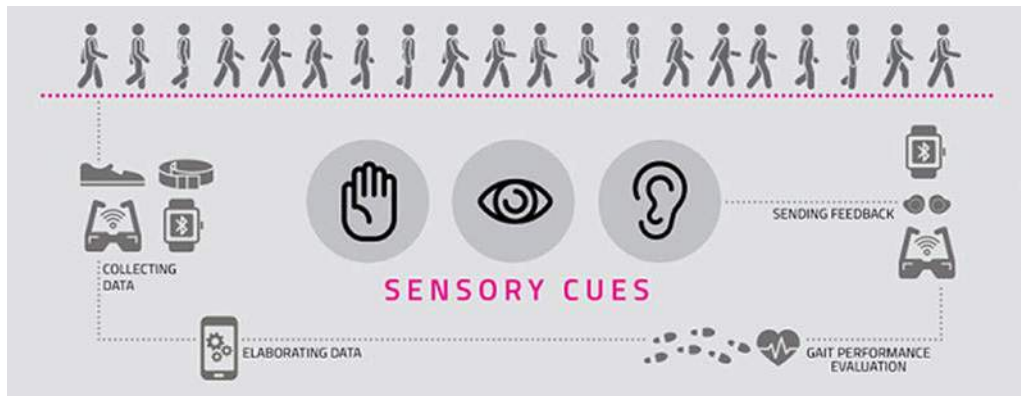


Fig. 2 PASSO, System layout. Simplified graphical representation of the system's strategies developed by PASSO to improve the gait of people with PD. Credits: Silvia Imbesi.

The second design cycle aimed to design a wearable device improving posture by transmitting haptic cues to the user practicing a training session: when the person assumes an unbalanced posture, the system detects it and submits in real-time a haptic signal in a specific part of the trunk depending on the person's postural instability.

Specifically, in this part of the project, it was investigated how many sensors and actuators should have this kind of device, and where should be positioned to influence postural issues like Pisa syndrome and forward lean of the trunk (Espay et al., 2016; Janca, 2002). The multidisciplinary team developed a mHealth system based on a wireless body sensor network enabling the real-time monitoring of trunk postural features.

After a deep analysis with the users, it was chosen to transmit the vibrating signal using as sensors and actuators smart-watches (SW) fastened to a wearable garment allowing specific configuration. Several layouts were evaluated, to understand which stimulus location could be perceived as more intense and ameliorate body posture, limiting the person's inclination on the frontal and mediolateral planes. Specifically, vibrations were located in different positions in the upper shoulders and blades area.

The finally chosen points of application on the chest or back are supposed to make the person straighten the trunk when hanging too far forward, as selected locations on the shoulders are supposed to bring the person to a correct posture when unbalanced to the side. Moreover, were tested different solutions for the vibrating signal, modulating its intensity, duration and rhythmic. Finally, it was chosen to apply a single, short, and intermittent vibration transmitted from the SW to the person's body Fig. 3.



In the developed mHealth system the SW acts as a remote control to set different modalities of use and start/stop, and as a sensor and actuator, returning the haptic stimulation in real-time. An Android app on a smartphone manages the system allowing one to set target postures.

The research team developed some prototypes to test the system in an ambulatory context, with the supervision and support of a medical operator. As in the previous cycle, a testing protocol allowed to collection quantitative and qualitative information about the postural improvement and the user's sensations about the wearable device.

Fig. 3
PASSO, wearing the device. The final prototype is a sort of postural band for the upper part of the body, allowing the positioning of the SW face in several configurations depending on personal preferences and medical needs. Credits: Silvia Imbesi.

App for the management of the system by different users

The third and last design cycle consisted of the design of the system interface following usability and accessibility requirements (Borsci & Federici, 2008). In this part of the project, two versions of the mobile application managing the system were developed, in different versions. The analyzing phase of this cycle suggested that it was necessary to personalize the app depending on the specific user. It was then decided to develop a version addressed to the patient with PD and another dedicated to the Medical Operator taking care of the patient's therapy.

People with PD are supposed to use the app when practicing a rehabilitation session by themselves in their environment. It is relevant for users to manage the system comfortably and to receive gratification as encouragement in the training (Kurniawan & Zaphiris, 2005; Nunes et al., 2016). Symptoms like hand motor impairments, difficulties in managing multitasking activities, and weakening of short-term memory, can create issues while using a mobile app (Espay et al., 2016; Montague et al., 2014; Trewin et al., 2013). Furthermore, typical interface gestures were analyzed to define the ones requiring lower motor and cognitive effort from the users (Nunes et al., 2016). To overcome possible limitations, the app version dedicated to patients presented a significant reduction of the system functions, keeping only fundamental ones for the training session management and the notification of the short report of a session.

Beyond aspects strictly related to real-time performance, a significant contribution to the personalization of the training and the monitoring of impairment evolution is given by performance monitoring (Mukhopadhyay, 2015). The collection of data regarding the person's walk, and their elaboration and comparison over time, allows for monitoring the person's capabilities and elaborating a tailored rehabilitation protocol (Espay et al., 2016).

Medical Operators should use the app during the patient's training in an ambulatory context. During the analyzing phase, they expressed the necessity of a simple interface without big amounts of data difficult to be interpreted, and a data visualization allowing a quick qualitative interpretation. In the developed prototype, Medical Operators can register the patients by creating personalized profiles, set thresholds (based on target trunk inclination angles) for the current training session, manage the current session, receive a report about every training session, access old reports and compare different sessions Fig. 4.



Fig. 4
PASSO, app screenshots. In the image are reported two screens of the system app in the medical operator's version. Precisely, the first image regards the patient's profile, and the second screen is the part where it is possible to set thresholds for the incoming training session. Credits: Silvia Imbesi.

Results

During the first cycle, it was conducted a deep analysis of cues' effects on the person's gait cadence. Among tested prototypes, the auditory and haptic cues reached a higher efficacy than the visual ones: while visual cues improve spatial gait parameters (e.g., stride length), auditory and somatosensory stimuli improve temporal gait features (e.g., cadence) (Imbesi, Corzani, et al., 2021). Auditory cues performing melodies with musical instruments were the most performing signal, influencing but not bothering the users.

The second cycle's output was the prototype of a wearable device using previously tested vibratory cues to maintain and correct the trunk posture during the gait. The innovative positioning of the vibrating stimulus on the upper part of the trunk was able to correct posture without needing an explanation of what to do when the biofeedback was submitted. This aspect seems to be very significant because it reduces the cognitive impact of the feedback on the person, lowering the mental effort requested for the posture-demanded correction.

The third and last cycle led to the design of a PD user and medical operator's interfaces of the system app. The testing phase confirmed that in health management, it is important to maintain, and if possible, to improve, motivation through accessibility and usability (Borsci & Federici, 2008). Moreover, even for people using an app for advanced professional tasks, it is fundamental to consider usability a priority. The design of a simple and intuitive data visualization and the choice of specific fonts, shapes, dimensions, and color palettes, guarantee the highest efficiency in completing tasks.

The tested protocols consisted in semi-structured interviews with users for qualitative information, and in a 30 meters straight walk wearing the smart garment, monitoring posture parameters and correcting unbalanced positions, for quantitative information.

During testing protocols with users with PD, the most important outcomes were related to the necessity of designed solutions to be tailored for the individuals both physically and technologically, and the possibility of being usable in daily life environments.

Even if there were some limitations concerning the ongoing pandemic and technical issues, obtained results confirmed the effectiveness of the developed smart system.

The applied methodology led to satisfactory results and proved to be particularly suitable for multidisciplinary design processes involving both human and technological factors, related to qualitative and quantitative evaluations, for the development of smart systems targeted to niche users (Imbesi, Corzani, et al., 2021).

Results obtained in the PASSO project are supposed to be used for people with PD in ambulatory contexts and outside specialized centers to rehabilitate postural and transient gait disturbances and provide training at home, respectively.

Conclusions

The PASSO project is developed with a comprehensive and cyclic approach, trying to develop UC methodological solutions in the complex field of smart devices for fragile people.

During the whole design process, three main categories of users were involved: Persons with PD, medical operators, and technical operators.

In three separate design cycles were designed sensory feedback, a wearable device transmitting them, and the system interface. Each design cycle comprised a verifying phase engaging users to perform a testing protocol for the validation of the prototype and confirm obtained results.

This design research project aims to impact the advancement of methodological guidelines for the design of UC solutions for older people affected by PD. This area is particularly challenging due to the need of integrating multidisciplinary teams and a heterogeneous body of knowledge. However, if validated on a larger sample, the proposed methodology might pave the way for a new generation of smart objects and medical devices.

In the long-term perspective, the main objective is to enrich the open system with other smart wearable devices, allowing the possibility of monitoring more parameters to optimize the training efficacy thanks to personalization.

Author roles acknowledgment

The current paper was conceived and written by Silvia Imbesi, and supervised by Giuseppe Mincoelli.

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She works as a research fellow, contract professor, and freelance designer in the fields of Human Centered Design, User-Centered Design, and Inclusive Design. Her research interests are currently related to design methodologies for the development of smart devices using the Internet of Things for healthcare purposes.

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Pathos: A digital service to improve women's hospital experience

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Abstract

In the healthcare systems mostly oriented towards clinical performance the risk to dehumanize patients subsists, perceiving them as people to fix just biologically. The relationship patient-caregiver and the need to probe patients' emotions is still a plus, not an integrated component of care. This research starts analysing the experience of female patients during the pre- and post-operative care in public hospitals within gynaecological departments, considering a sample from 16 to 60 years old. The main goal is to develop a digital healthcare service to improve the hospital stay before and after surgery, enhancing care quality, patients' experience and co-create value with the patients. The research spur to develop a project based on Service design methodology, with a Human Centred Design approach. The intention is to raise awareness about the importance of a different healthcare approach like Patient Centred, where women are the fulcrum in which the whole process revolves.

Keywords

Patient centered care
Women healthcare
Empathy
Gynecology hospitalization
Service design

Introduction

Medicine has always aimed to guarantee an effective path that prioritizes technical progress, evidence, targets and efficiency, reducing the patient as an object of intellectual interest. Healthcare professionals separate themselves from the patient to avoid emotions, focusing more on biomedical facts (Jeffrey, 2016). The main problem is that the mechanistic organizational healthcare system creates dehumanization that can alienate clinicians from patients. This phenomenon produces the rejection of another person's dignity that can strongly affect the hospitalization, even if the cure was successful. The consequences of empathy reduction and moral disengagement are that patients are perceived as non-human beings (Haque & Waytz, 2012). Moreover, the fatigue, the overwork, the lack of continuity with the patient can exacerbate the environment. The effect could be a punitive climate, lack of compassion and tolerance. The absence of communication and empathy from the hospital team can hugely invalidate a patient's experience before and after receiving surgery. According to Ambady et al. (2002), doctors who were perceived as more dominant and less worried in their tone of voice were more likely to be sued than surgeons who were perceived as less authoritative and more involved in the presence of their patients. That is why it is important to consider a new approach of healthcare patient centred, switching from the traditional paternalistic relationship doctor-patient, to a new participative one (Perino, 2002). Physician consultations in which patients were allowed to express their emotions, concerns, ideas, and questions were observed to yield better outcomes and boost patient satisfaction (Zandbelt et al., 2007).

It is crucial the role that communication plays. M.A. Stewart (1995) demonstrated that an effective and positive communication affects the patients' emotional health and brings to symptom resolution, a more functional status and pain control. C. Rogers (1951) identified three necessary conditions for a helpful inter personal relationship between physicians and patient: congruence and transparency, unconditional positive regard and empathic understanding.

In addition to physicians another important component is the nurse. Nurses work as translators between patients and doctors. They have many interactions with patients and families involving general discussion topics, sharing details about themselves and offering non-verbal communication (Slatore et al., 2012). They should represent a tender presence, manifesting care along communication, approaching the patient as a person, having the skills to be able to diverge from established norms if required. Through this path, the nurse can provide an effective care that reduces the underestimation of patient identity and expands the explanatory perspective of illness. Nurses who use Patient Centred Care have the power to reduce adverse outcomes from patients. D. Wolf et al. (2008) illustrates that nurses who used PCC influenced pre-surgery preparations positively and helped patients fill discharge prescriptions.

To embrace the patient care approach, it is needed a holistic way of thinking, that involves both clinicians and patients. Arise the need of a new model of healthcare worker-patient relationship, whose objective is to diagnose and treat like a disease centred approach but considering also the emotional impact that the disease has on patients.

Patient satisfaction in women's health and other specializations is poorly known. According to the 2006 American College of Obstetricians and Gynaecologist survey on professional liability, a professional can be sued for malpractice with a risk of 89.2% during his or her working life (Williams, 2008). The higher percentage of malpractice cases filed in the field of obstetrics and gynaecology shows that there are differences in patient satisfaction across medical specialties. Interpersonal components of care may have a significant impact on a patient's decision to sue their doctor, as malpractice suits have been linked not only to physician's errors and carelessness, but with the communication's quality too (Yeh & Nagel, 2010).

Physician-patient communication may need to be improved to an even higher degree in the department of obstetrics and gynaecology in order to improve patient satisfaction, because these patients sometimes differ substantially from general ones, in terms of their moods and emotions (Chang et al., 2006). The health issues that gynaecologists deal with are frequently intimate and can have a significant emotional impact. First-time pregnant mothers are an excellent example of patients that require clinicians to be more aware of their communication style because they can feel a high level of anxiety and an incapacity to manage their own body.

In maternity care, communication variables like "adequate time spent discussing difficulties," "using words I could understand," and "tried to understand how I felt" were statistically significant in predicting patient satisfaction with prenatal care (Sullivan & Beeman, 1982). Furthermore, it has been observed that in an emergency department women tend to trust more female doctors rather than male, because of a better communication that generates adherence to therapy. They have a comprehension of patients' problems from a biopsychosocial perspective, with more verbal exchange in consultations, open ended questions, and emotional talk (Beck et al., 2002). Even early pregnancy loss can be processed using a patient centred care approach. Patient preferences play an important role in clinical decisions on early pregnancy loss treatment and they are influenced by individual circumstances, expectations, knowledge of the benefits and drawbacks of various management options. EPL management decisions are frequently made in the presence of complicated emotions such as shock, disappointment, grief and relief. Patients have expressed dissatisfaction with clinicians who handled their miscarriage as routine and lacked empathy or urgency in dealing with their situation (Shorter et al., 2019).

The first national research carried out in 2017 by Doxa-OVO Italia, claims that In Italy there is an estimation of 1 million mothers, 21% of the total, who affirm to have been victims of physical or psychological obstetric violence at their first experience of motherhood. The survey "*Women and childbirth*", was conducted on a representative sample of 5 million Italian women, aged between 18-54, with at least one child of 0-14 years. It analysed different aspects lived by mothers during the stages of childbirth in hospitals: the relationship with health workers, the clinical treatment, the communication used by medical staff, the informed consent, the role of pregnant woman in delivery decisions and the respect for human dignity. 41% declare that

childbirth assistance was hurtful for their dignity and psychophysical integrity. Moreover 27% of the interviewees have felt poorly assisted by the medical team, expecting to be more involved in what was happening during childbirth. 6% of new mothers claim to have lived the entire birth alone, without adequate assistance and 1 woman out of 3 felt cut off from the fundamental decisions and choices affecting her birth and hospitalization. 27% of mothers complain of a lack of support, 19% lack of intimacy during their hospital stay.

Recognizing and respecting a woman's preference for management could help her regain her sense of dignity and power. There may be misunderstandings and misconceptions between the physician and the patient, which can be remedied by helpful and therapeutic communication. This can lead to Shared Decision Making, using PCC communication techniques as a tool, creating a partnership and balance of power during such an intimate and personal experience that can leave women shocked and emotionally confused.

Patient Centred Care in Italy

In the Italian context, the patient-centeredness of care is still understudied, and to date there has been a lack of research in this field (Coluccia, 2014).

During the 2019 *Patient Value Summit* in Brussels, the Economist Intelligence Unit presented a Patient Centred Care report on nine countries, Italy included, that highlights the key factors that should be considered in order to achieve patient-centred healthcare. To understand how worldwide healthcare systems have been built around patients' values and needs, the Economist Intelligence Unit developed a benchmarking tool, with different qualitative indicators to evaluate the adoption of patient centred principles and national policies into healthcare protocols. They also conducted surveys targeting five organizations for each country where patients' groups, stakeholders and healthcare professionals were interviewed, investigating how patient values are considered in policy propositions and care instruction.

The findings about Italy were that a legislation relating to patients' rights exists, although there is no national policy for patient-centred care. Italy struggles to translate national policies into clinical recommendations, and also lacks policy on personalized care and shared decision-making, although some initiatives exist. The Italian weak points regard patient involvement in shared decision making, a personalized care according to patients' values, the use of measuring tools for patient-reported outcomes and a low strategy on national quality standards to monitor the implementation of patient centred care. The most problematic points on patient experience are the lack of interest from care professionals in what patients have to say and the lack of courtesy and respect at all stages of the admission process. About shared decision making the lowest grade regards the quality of information offered to patients. For inclusiveness and support, Italy has a very poor score within respect for cultural differences and there is still a huge bias in healthcare treatment not only for cultures but also for genders. The worst outcome

for Italian patients refers to patients' feelings: their emotional needs are not being addressed. It is the lowest score compared with other countries. Assistance for emotional and social care appears to be lacking or insufficiently prioritized by Italian healthcare (Economist Intelligence Unit, 2019).

Surely there are limitations in this report, such as the inability to cover all therapy areas and, in some cases, the survey responses may reflect the perspectives of healthcare professionals rather than patients. Nonetheless, this research raises numerous discussion points that align with the qualitative and quantitative data gathered during the study.

Methodology

The best way to enhance a good hospitalization experience is re-imagining a new healthcare service. To redesign a better system of care the main query is how is it possible to transform empathy as an important part of the process. How can it be measurable? How can be promoted to clinicians not only the biological parameters, but also the emotional ones? Designing a patient support system that is not burdening on clinicians, can be a way to improve the involvement of patient-doctors.

The methodology used for this research taps into the Service design and a Human Centred Design approach. The discovery phase started with a previous desk research.

The search strategy used heading terms like *patient centred care*, *patient needs*, *gynaecology and obstetrics*, *patient satisfaction*, *healthcare biases*, *malpractice*, *patient centred communication* on Medline, ResearchGate, The Open Health Services and Policy Journal, Harvard articles, Elsevier. After collecting secondary research data, the primary research started with online questionnaires and in-depth interviews about the pain points and needs of patients and healthcare professionals, creating a step-by-step documentation of their service experience. The online survey helped to create a baseline for data. It was a useful tool for gathering basic quantitative data from women that experienced surgery with a short hospital stay in a gynaecological-obstetric department in Italy. The women targeted age was between 16 and over 60. The respondents have been 32 women. The survey consists of 23 questions studied to avoid influencing the respondents. It emerged that the biggest difficulty during the hospital stay was the lack of empathy from the medical staff; before the surgery the biggest issue was poor quality of information and after surgery was the lack of assistance.

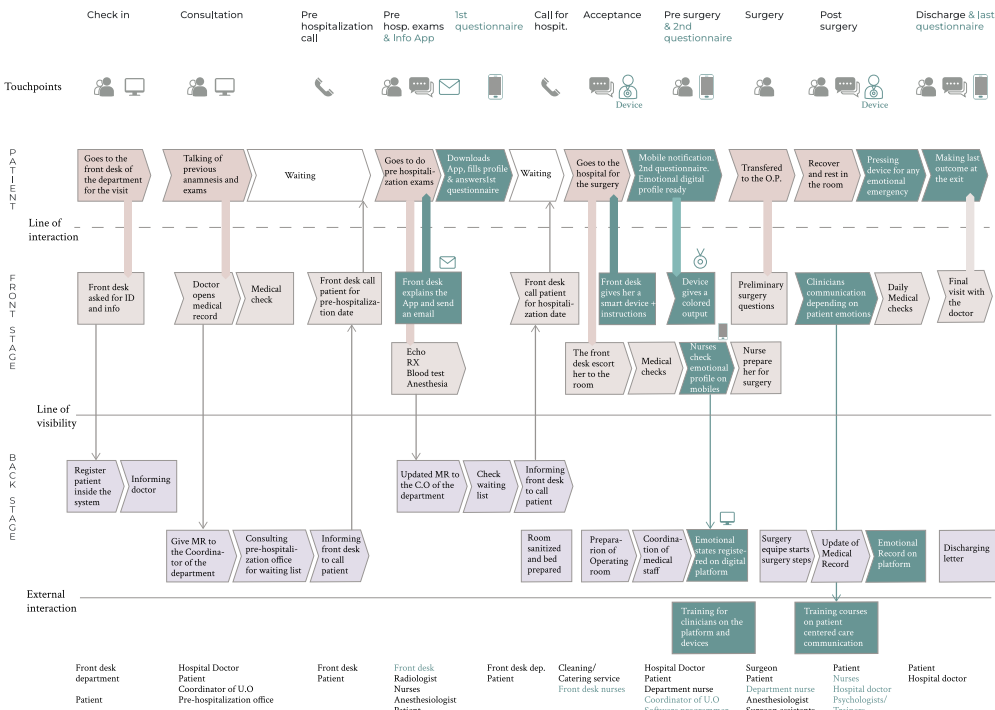
The survey was paired with 7 in-depth interviews, that were audio recorded, transcribed and verified for accuracy: 4 patients and 3 professionals. The interviews helped to identify major themes regarding patient's roles, emotions, preferences, negative experiences and hospital working issues. Comparisons were made between observed dialogue and behaviour. The interviews had been visualized and synthesized, using empathy maps, personas (3 patients, 1 nurse) and journey maps to understand the user needs. The issues revealed in the primary research matched with the desk research: the main user needs are clear information (communication,

clarity, participation), empathy (consideration, reassurance, sharing) and assistance (hygiene, painkillers).

The ideation process came up with a digital service, Pathos, that redesign the organizing procedure during the pre-hospitalization and hospitalization phase. Patient's emotions and moods are considered a consistent part of the data, creating alongside the PMR (Patient Medical Record) the PER (Patient Emotional Record) during the patient's journey. With the help of a Cloud emotional data management system, a mobile App and a smart necklace device, the emotions, expectations and concerns of patients are registered and stored online to be consulted on computers and portable mini tablets. This way, nurses and obstetrics can be aware of patient's emotions, changing approach and communication to a more patient-centred one. A previous professional training on patient-centred care communications will be imparted to doctors and nurses, helping to adapt communication based on patient's emotions. It is crucial that this training will guarantee to healthcare workers a consistent number of credits on the Professional Association of Doctors and Nurses. The results will be a more active participation of patients through the App's usage, a holistic consideration of patients from physicians, a better patient-doctor communication, a record of the emotions and issues experienced before and after surgery that will be open-access for patients, a better awareness about what happened during the patients journey and the usage of empathy as part of the process. The service is designed for public or private hospitals, starting from gynaecological-obstetric departments.

The research led to analyse the programmed hospitalization's steps.

After a deep analysis of the front and back-end processes of a programmed hospitalization in an Italian public hospital it was crucial to redesign the front-back operations inserting a digitalized approach that can help patients to express their emotional status, record it, store it, download it, being aware of what is going on. The goal is to make the healthcare team aware of patient's inner state, spurring them to use an empathic communication able to reassure patients and manage them depending on their moods. This way the communication patient-clinicians is improved, patients don't feel lonely and mistreated, patients' outcomes enhance, they start to participate in some parts of the process and feel considered. Even clinicians will be more satisfied by the positive attitude of people they take care.



New Hospitalization steps with Pathos

Up till the pre-hospitalization call, every step is the same as the traditional system. The first change will appear after the pre-hospitalization exams. The hospital front desk, or department desk, will explain the existence of a new service on a face-to-face conversation.

The user can download an App that helps patients to monitor and record their emotional profiles during the hospitalization stay. After a short explanation of the App, an email will be sent to the patient with a downloading link. That link will redirect the user to the Apple Store to download the App Pathos. She can register by email or using her tax number. A first questionnaire will appear with four questions related to her expectations and ideas of the future hospitalization. At the end of it, the App let her intend that the next step will occur at the beginning of the hospitalization.

The hospitalization day she will receive from the front office Department a smart transmitter to wear as a necklace, explaining that it is recommended to have it on during the whole stay. This transmitter will interact with the App due to NFC technology.

After being admitted, she will receive a notification on her mobile to start the second questionnaire and other activities. The App will detect which is her actual mood, her feelings, if there is something upsetting, creating a final emotional profile. The App will ask to turn the NFC mood On and put the mobile close to the necklace. The proximity of the mobile will trigger the necklace device to show a colored output, thanks to the NFC technology. There will be four

Fig. 1
Pathos Service Blueprint.
Map of the hospitalization process; the new service experiences introduced by Pathos are highlighted in light blue. Credits: authors.

emotional statuses: anger, fear, sadness and neutral-positive. The coloured necklace helps give immediate visual emotional feedback to nurses and doctors, to have a visual fast evaluation of her status.

Furthermore, the necklace is equipped with a button. Patients press the button every time they have an emotional spike, like a panic event or a weeping moment.

Nurses must check at least once a day the patient's emotional profile with a Mini Tablet. When they tap the tablet close to the patient's necklace, they are able to read the entire emotional profile of the patient with NFC technology, seeing what caused the emotional spike. This is a way to change physicians' behaviour, directing them to communicate with patients, calming them, reassuring them or giving them explanations if needed.

All the devices are controlled and monitored in a centralized Cloud clinical data Management System in the department office. Thanks to repeaters into the hospital department the information will be transmitted wirelessly between the App, the device and the Cloud software. With this system it is possible to check which devices are on, to whom they have been assigned, the emotional profile of every patient and all the related data. The central system will record every mood spike and a mobile alert notification will be sent to the nurses. The emotional profile can be updated by the patient every moment, because mood changes and its motivations too. The device colour will shift consequently. Every feeling and its evolution will be recorded as a significant data to improve patient care communication.

Doctors will be informed about the emotional conditions and issues of the patient whenever they do the daily visit, to adapt their patient-care communication depending on patient mood. However, they can read the patient emotional profile tapping their mobile/tablet on patient's necklace.

At the end of the path, when the discharge step is close, the App will send the last notification with the final survey to fill, giving overall feedback about the treatment, the empathy received, the positive and negative moments. This way, women can express their opinions and help the service to enhance. Before leaving the hospital, the patient delivers the necklace device to the department office. They will disinfect it, check the data inside and reprogram it through a dock station. This station could recharge both mini tablet and smart devices.

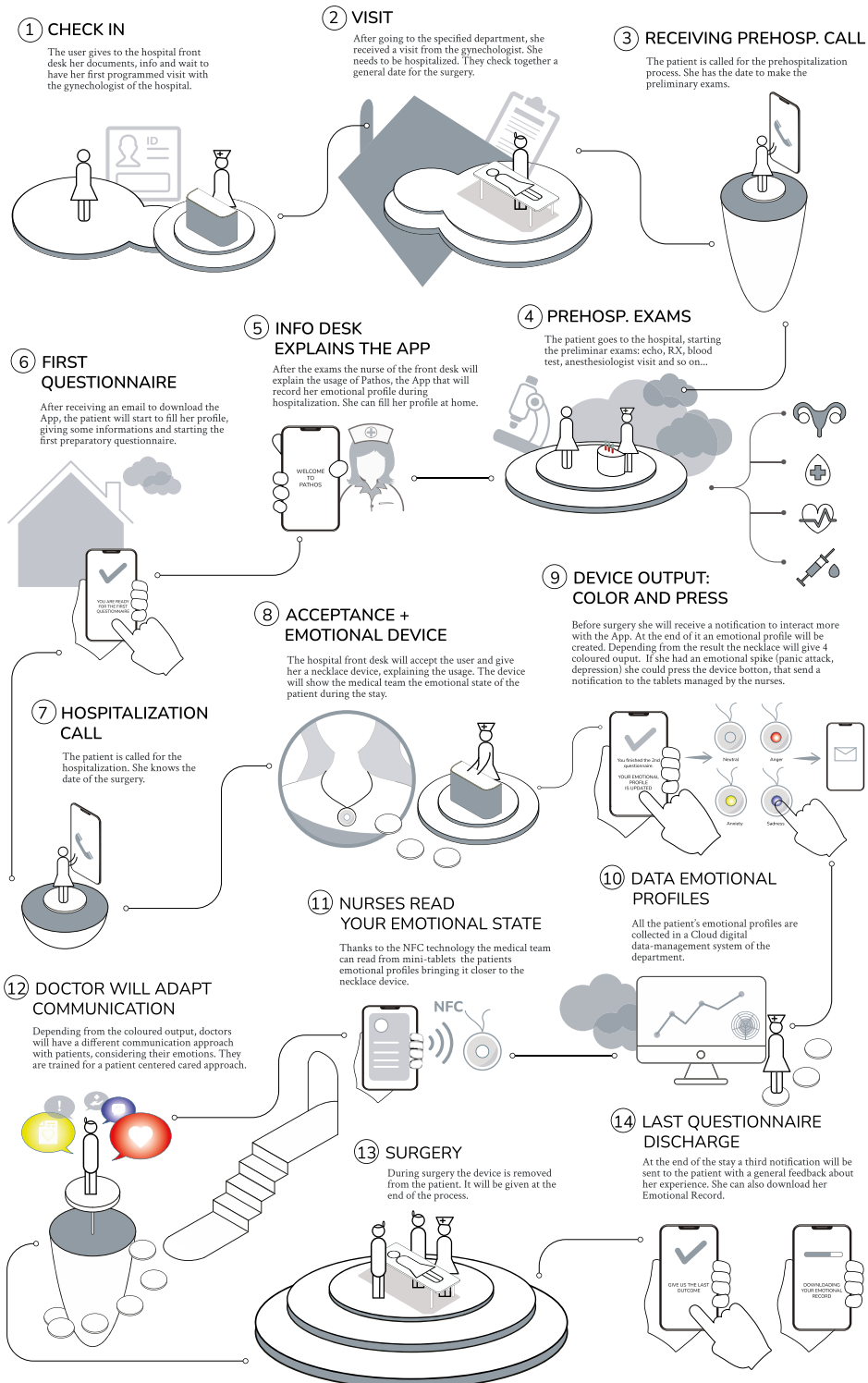


Fig. 2



Fig. 3

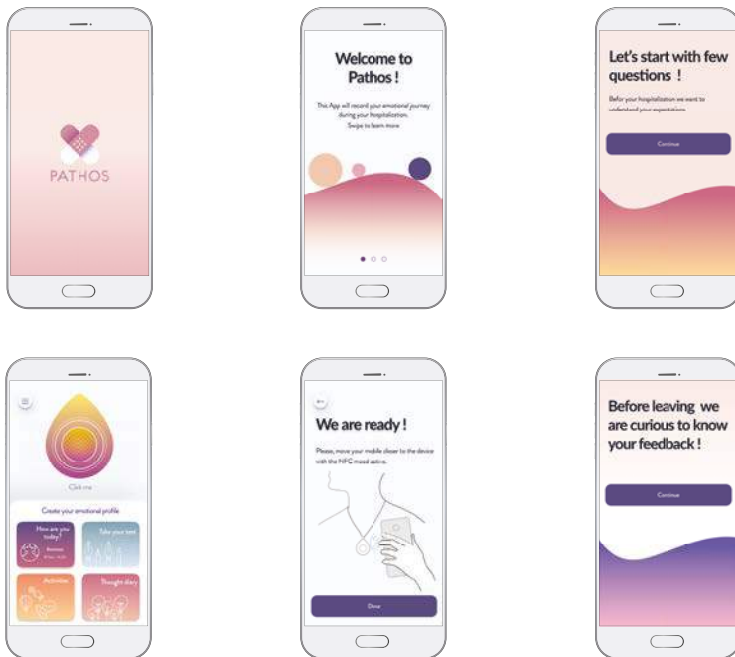


Fig. 4

Results

The project testing occurred with automated test and moderated sessions. The automated test was created with an online tool named Maze. With it, it was possible to send the App prototype to different users on remote, asking them to complete specific tasks. With the moderated sessions instead, it was possible to talk with people, allowing to dig deep and understand the “why” behind their behaviour.

The overall results could be divided in three sections: the dimensional outcome of the necklace device, the interactive outcome from the App tester and a medical staff interaction with the service.

The first finding is that 90% of interviewed women liked the drop shape of the neck device, considering the dimension adequate, a positive touching sensation and an easy-to-understand interaction. The most appreciated qualities were the lightweight and the compact size.

The implementation on the App Interface could have been on the colour's palette, exploring different colours, replacing the swipe interaction at the beginning with a simple tap interaction. The overall observations were that the interactions were not frustrating and easy to accomplish.

The third section is still ongoing, aiming to create valid outcomes from a medical team that interacts with the software and the device in a hospital. It could be interesting to examine the integration of this service in the University Hospital of Policlinic Umberto I or the Sant' Andrea Hospital in Rome, to spread in a public hospital a service that highlight the importance of women's emotions.

Fig. 2
User Scenario. Visual narration for the user behaviour using Pathos service from the hospital check in to the discharge. Credits: authors.

Fig. 3
Clinical data Management Interface. Main Home Page with User Interface flow. Credits: authors.

Fig. 4
Pathos App. Screenshots of Pathos App used by patients. Credits: authors.

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IF THIS THEN THAT Broken Linear Logic. Rethinking and Representing the Design Process

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Abstract

Since its origins, the discipline of Design has developed in close connection with technological progress, trying to adapt its processes, approaches and methodologies. What we are questioning is how much Design has actually been successful in converging towards a disciplinary model suitable to the most recent technological evolutions such as AI and data-driven approaches, and, first of all, how much the way of thinking of designers has changed in this direction. Through an evaluation of design approaches, methodologies and processes from an historical point of view, the aim of this paper is to surface the misalignment between contemporary design processes logic and the linearity of its common representations, due to recent technological advancements. In fact, the representation of a process affects the epistemology of the process itself. This contribution presents on-going research based on literature review and mapping of contemporary design processes structures and representations, in order to define some good attempts and practices useful for building more reliable representations of design processes able to deal with challenges in a highly-technologically advanced present.

Keywords

Design process representation
Artificial intelligence
Antidisciplinarity
Design thinking
Creativity

Introduction

This paper contributes to the topic of “Design and Responsive Technologies for Human Wellbeing,” recognizing that technology, as the key element of this track, goes beyond practical applications on products and bodies. It fundamentally relates to the design process itself. Positioned within the broader context of the 8th Forum of Design as a Process, our contribution focuses on the overarching concept of Design as a Process. In our perspective, technological advancements have significantly influenced design processes and their representations, cutting across all the proposed tracks.

Before delving into the specific applications of responsive technologies for human wellbeing, it is crucial to reflect on the intricate relationship between technologies and the design process. Through an extensive literature review, we have identified gaps, particularly in the representation of design processes. Traditional representations often fail to align with contemporary design practices, characterized by inter/multi-disciplinary projects addressing complex and wicked problem spaces.

Recognizing that, we question the extent to which Design has successfully converged towards a disciplinary model suitable for recent technological evolutions, including AI and data-driven approaches. Additionally, we investigate how designers’ ways of thinking have evolved in this direction.

The aim of this paper is to evaluate design approaches, methodologies, and processes from a historical perspective, shedding light on the misalignment between the logic of contemporary design processes and the linearity often portrayed in their representations. This misalignment can be attributed to recent technological advancements. The representation of a process significantly influences its epistemology. Drawing inspiration from the concept of “If This Then That” derived from coding culture, which describes a deterministic approach, we argue that contemporary representations of design processes should embrace non-deterministic and non-linear approaches. By doing so, we can positively influence the way we design in the contemporary context.

Through an exploration of various case studies, we analyze the historical progression of design process representations. From the conceptualization of Industrial Design and its alignment with mass production processes, to the subsequent shift towards user-centered and human-centered design models, we observe a gradual evolution. However, as design increasingly deals with complex and wicked problems, there is a notable lack of representation models that move beyond linearity.

The representation of the design process has gradually shifted towards depictions of the space and relationships in which projects are embedded. This shift acknowledges the need to move away from normalizing the designer’s work and instead supports exploration and the surfacing of meanings. As complexity increases, design processes require non-linear logics, probabilistic dimensions, multidimensional and dynamic representation models, and integration of variables and multiple dimensions. By embracing these approaches, design can effectively navigate the complexities of the contemporary context and the underlying conceptual models that inform responsive technologies for human wellbeing.

A brief history of linearity in design processes representation

During the history of design as a discipline, design processes have been mainly represented through linear models. Starting from the conceptualization of Industrial Design, the discipline evolved at the same time as mass production processes (Celaschi et al., 2019), gradually distancing itself from the craft dimension of the project, in favour of a greater relationship with production systems. In this period, the linearity of the design process is attributable to production processes standardization, which characterised most part of the 20th century and led to the abstraction of design processes as a sequence of pre-determined phases during the 1960s (Vitta, 2011) *Tab. I.*

Since the 1980s, design processes have evolved due to the major diffusion of computer systems, which started becoming a commercial product that needed specific attention in designing ways of interaction with humans. In this context, the focus of design processes has progressively shifted away from the product and its production technology, in favour of design models centred on human beings, considered initially as “users”, as in the case of User-centred Design, and then in “humans”, as in the case of so-called Human-centred Design. The main difference between those two approaches is that in the first case the needs of humans are included only for what concerns the experience of humans as final users of a product, while in the second cases the concept of human needs is broadened and includes also other aspects of human life. Those new paradigms have made it necessary to re-think the design processes in order to include specific phases related to user and human research inclusion, but have mainly been represented through linear models, sometimes including iterations.

Gradually, design as a discipline started to deal with so-called *wicked problems* (Rittel & Webber, 1973; Tonkinwise, 2015), i.e. complex problems that are seemingly impossible to solve through traditionally tech-centred approaches as they are characterised by the interaction between different social spheres. For this reason, as a result of technological and environmental transformations, the concept of human-centred is relocating in favour of systemic approaches that consider the centrality of multiple subjects that include both human and non-human subjects (Forlano, 2017; Tironi et al., 2022). Moreover, global transformations, such as climate change or the covid-19 pandemics, cannot be addressed simply by using more resources or applying more control: Design needs to rethink its models and practices in order to respect different ways of knowing, understanding and creating the world (Escobar, 2018). Even in this context, there is a lack of design process representation which is not characterised by linearity.

COMPLEXITY	PROBLEM-ATIC FIELDS	DISCIPLINARY FIELDS	APPROACHES	TECHNOLOGY PROCESS PUSH	MODEL
1 Complexity Factor Or Low Complexity Level	Artefact/Product	Engineering	<ul style="list-style-type: none"> • Process Tech Centred (1960s) • User Centred (Late 1970s) • Human Centred (1980s) 	Mass Production	Linear
<=2 Complexity Factors	Service	Engineering and Social Science	<ul style="list-style-type: none"> • Design Thinking (1990s) • Human Centred (1990s) 	HCI	Linear but Iterative
<=3 Complexity Factors	Multistakeholder	Engineering and Social Science and Hard	<ul style="list-style-type: none"> • Systemic Design (2000s) • Participatory Design/Co-Design (2000s) • Speculative Design (2010s) 	Web/Mobile	Linear but Iterative
>3 Complexity Factors	Wicked Problems	Engineering, Social Science, Hard, Environmental Sciences (And the Diffusion of Various Studies	<ul style="list-style-type: none"> • Systemic Design (2000s) • Transition Design (2010s) • More Than Human Design/Post Human Design (late 2010s) • Design for the Pluriverse (2018) 	AI/ Ubiquitous Computing/ IOT	?

In an attempt to understand how, and if, the ways in which we represent design processes influence how we actually *do* design, we have systematized some of the above-mentioned approaches and movements into a matrix Tab. I. We have selected at least two significant *approaches* per decade, starting from the 1960s to the present. The lack of a representation model is immediately evident relating to clustered approaches in the last row of the matrix, i.e. what is marked with a question mark in the bottom right-hand corner. First, we matched the *problematic field* that went from artifact/product to service, then to multistakeholder and finally to wicked problems, a class of social system problems that are poorly formulated, where information is confused, where there are many customers and decision-makers with conflicting values, and where the ramifications of the whole system are completely confused (Rittel and Webber, 1973). So, wicked problems are those that recognize the complex interdependence of different factors and stakeholders, rather than simplistic and linear cause-effect abstractions that isolate the design product from its context.

For each approach, we have defined a main *disciplinary field*, noting a progressive difficulty in defining disciplinary boundaries. In this context, paradigm changes due to *technological pushes* have been considered, as they present a relation also with the definition of a disciplinary context itself. Then, we have defined different *levels of complexity* in order to group and classify each approach, starting from the principles defined by Coyne (2005)¹, who has defined wicked problems as problems characterised by three or more levels of complexity, and by a fundamental unpredictability and uncontrollability beyond a very limited scale of space and time.

This framework led us to understand that a growing technological process is related to a growing level of complexity, which lead to a major diversification in involved disciplinary fields and approaches. What is unvaried, is a tendency in representing design processes still with linear models.

Tab. I
The table shows how with the progression across time, as complexity increases, the representation of the design process stops at linear models.

1
Wicked problems persist and are subject to redefinition and resolution in different ways over time. Wicked problems are not objectively given, but their formulation already depends on the point of view of those presenting them. There is no definitive test of the validity of solutions to an evil problem. The testing of solutions takes place in a practical context and solutions are not easily invalidated.

The cure as metaphor of

“A brain tumor. Very personal open data. An opportunity. We can change the meaning of the word cure. We can transform the role of knowledge. We can be human.” (Iaconesi & Persico, 2016, p. 119)

In 2012, after finding out about his brain cancer, Salvatore Iaconesi decided to leave the hospital and make his cancer open-source, building in the network and with the network his Cure Fig. 1. It was in this way that Salvatore's medical file turned into a collective cure, a publicly open debate, a performance between human beings with the aim not only of finding a cure but of discovering how to implement a society where the well-being of the individual depends on the others. A cure which is defined as peer-to-peer and ecosystemic, a cure that is multidirectional, emergent, oblique, exploded, disseminated, non-linear.

Researchers, communicators, artists, activists, theorists of all kinds, experts in magic and esotericism, patients, ex-patients, hackers, scientists, doctors, entrepreneurs, start-uppers, even conspiracy theorists, and so on towards an enormous international community that dialogued, generating in a very short time three hundred thousand e-mails, two hundred thousand messages on YouTube, half a million messages on social networks. (Iaconesi & Persico, 2016)

It is within this community that Iaconesi has built his cure, which has allowed him not only to build a customised one, but to build one that derives from collective intelligence, non-protocol, for a human and not for a number. A cure that in 2012 allowed him to recover for a few years from cancer.

We recognise in this event a structure and a dynamic not entirely different from that of disciplines, or the future of some disciplines. We recognise in words such as ecosystem, collectivity, non-linearity, open-source, part of the description of how to design in the field of Responsive Technologies for Human Wellbeing, of how to design in the field of Design in general.

We have a responsibility as designers to always ask ourselves, as we design, how we are doing it. But what we ask is: how can we think about explaining and representing a design process like The Cure through linear frameworks² as the Double Diamond?

Although an iterative approach is indicated for the use of these models, they remain grounded on a logic between consequential steps.



Fig. 1
 “Rehearsing at TEDGlobal 2013” by xdx_d_vs_xdx_d. laconesi during his speech at showing the dynamic representation of The Cure. Source: https://www.flickr.com/photos/xdx_d_vs_xdx_d/9051531749/, Licensed under CC BY-SA 2.0.

AI systems

Crawford and Joler’s *Anatomy of an AI System* (2018) is a look at the hidden environmental and social costs of our current dependence on artificial intelligence. Through a detailed case study of a commercial AI system, they trace the many costs of this technology – from the energy used to power the system, to the carbon emissions generated, to the human labor required to maintain and operate it Fig. 2. Many different types of data, including text, images, and audio, many different types of materials, including plastic, glass, and metal. And there are many different types of human labor, including customer service, marketing, sales and contemporary mechanical turks (Buhmester et. al. 2011).

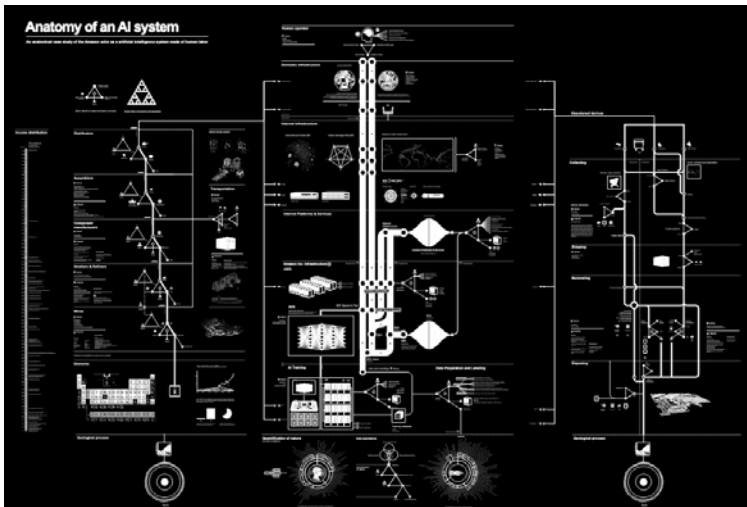


Fig. 2
 “Anatomy of an AI System: The Amazon Echo As An Anatomical Map of Human Labor, Data and Planetary Resources” by Kate Crawford and Vladan Joler. Source: <https://anatomyof.ai/img/ai-anatomy-map.pdf>

All of these different types of data, materials, biodiversity and human labor are interconnected: customers' behaviors data are used to improve the marketing, which in turn improves the sales and then used to improve even the design of the device. These devices are the product of complex supply chain systems that take years to be mapped, and where the authors see an analogy to the global information network.

Linear design processes and their representations are insufficient to render this environment because they fail to take into account the complex, non-linear interactions between the different components of an AI system. These interactions are what give AI systems their unique capabilities and make them so difficult to design and manage. By ignoring them, linear design processes and their representations give us a false sense of understanding and control over AI systems.

The more complex an AI system becomes, the more difficult it is to integrate into existing disciplinary frameworks, they increasingly rely on a variety of specialized sub-disciplines for their development and operation. This trend toward greater complexity and reliance on knowledge that falls in the blank space among disciplines is known as antidisciplinarity (Ito, 2014). There are a number of reasons for this trend toward antidisciplinarity as AI systems become more complex: 1) they require more data and the use of multi-disciplinary knowledge, 2) they become more difficult to understand and control requiring the contribution of multiple experts in order to develop and operate, 3) they become more capable of autonomously generating new knowledge which often falls outside of the scope of existing disciplinary frameworks.

Good attempts

Designers have long been interested in understanding and representing the design process. With the increasing complexity of design problems, more interest has shifted towards non-linear representations of the design process. A few examples are provided as good attempts in this direction.

In 1969, the Musée des Arts Décoratifs invited some designers to participate in the exhibition, *Qu'est ce que le design?*. Participants submitted work responses to a series of questions about the nature of the design process. Among them Charles Eames (1969) presented a conceptual diagram of the design spaces. The design space is a multidimensional one in which the designer can move freely to explore different design options. The Charles Eames conceptual diagram of the design space is a useful tool for understanding the non-linear nature of the design process. The diagram shows the different levels of the design process, from the initial concept to the final product. The designer can move back and forth between these levels, making changes at each stage.

More oriented to guide designers through different levels of thinking despite a sequence of steps, the Heuristic Design Framework by Arnold Wasserman is an example of high-level framework (Scupeili, 2015). It provides a set of heuristics, or rules of thumb, that the designer can use to generate and evaluate ideas. The framework

is flexible and can be customized to the specific needs of the project. However, it may be too high-level and better serve a strategic intent than a design intent.

Neri Oxman (2016) in his contribution in the first issue of JoDS (Journal of Design and Science) titled 'Age of Entanglement' writing about the disciplines boundaries, introduces The Krebs Cycle of Creativity Fig. 3. Oxman's model is a theoretical model that describes the creative process as a cyclical process of knowledge creation. It's original in its perspective, entangling different fields of knowledge in the creative process. However, it is also highly theoretical and may not be applicable to all design situations.

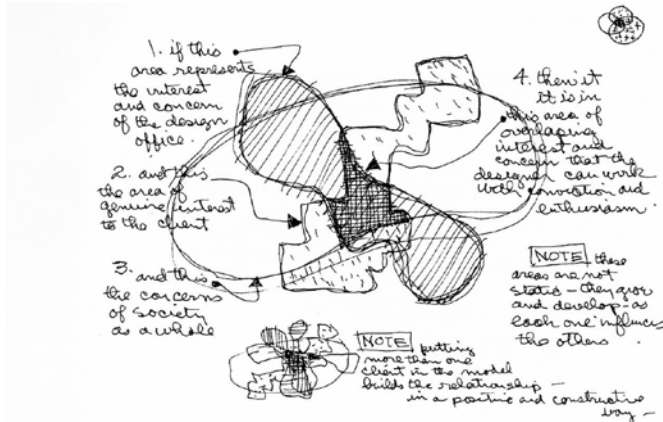


Fig. 3
"Krebs Cycle of Creativity"
by Neri Oxman. Source:
<https://anatomyof.ai/img/ai-anatomy-map.pdf>

Conclusion

As it emerges from the case studies the representation of the design process has progressively given way to the depiction of the space and relationships in which the project is embedded, implicitly abandoning the need to normalize the designer's work in broad terms, to support it more in the exploration and surfacing of meanings.

This suggests to us a strong resonance with the concept of data and its meaning in relation to the context in which it is generated, hinting that in complexity, design action also tends to escape codified and repeatable processual patterns, finding its most effective representation through the semantic and relational dimensions of the system in which it operates.

Likewise, this paradigm metaphorically represents – and in keeping with the new cultural directions of design tending to embrace multiple points of view and epistemologies – the abandonment of a way of portraying the design space from one's own unique point of view by decentralizing the perspective of representation as well.

Just as Iaconesi and Persico present "La Cura" space through a three-dimensional and dynamic model, Crawford and Joler include in their representation a system of ontologically very different and heterogeneous actors, generating a unique space of meanings of an emergent nature, just like the properties of a complex system that become apparent only in the relationship and never in the single component.

From the historical analysis, the elaboration of Table 1 and the different case studies, we can in conclusion, summarise that design processes representations should:

- embrace non-linear logics in order to deal and work with technologies such as AI
- exceed linearity in order to introduce probabilistic dimensions, needed to deal with highly complex problems
- introduce multidimensional and dynamic representation models, also by making them interactive, in order to manage the multiple variables required to represent a context characterised by complexity
- allow the integration of variables and multiple dimensions, accommodating a more layered thinking that must take shape from a multidisciplinary field, being able to become antidisiplinary while maintaining its representability.

Just as the technological architectures at the base of responsive applications - increasingly conceived through the use of meta-systems and the use of computation to build formal probabilistic models to handle multi-causality and the interaction between combined parts in a whole (Henriques, 2016) - the representations of these design spaces must find answers that satisfy the same level of complexity as the underlying conceptual models.

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Health Communication as Apo-Mediation. The Impact of Communication Design on Health Prevention and Perception

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Abstract

Considering the paradigmatic evolution of the concept of health into physical, psychological, and social well-being and its relational dimension determined by the continuous exchange between individuals, Design for Health Communication has developed new services, tools, and languages. This discussion paper aims to highlight the pivotal role of Communication Design in ensuring accessible content for health prevention and developing tools to inform citizens regarding medical issues and pro-health attitudes and behaviour. As evidence of the research conducted on the sanitary districts of Piacenza, the definition of guidelines for accessible sanitary networks and social actors in the territory redefines the designer's responsibility as a bridge between citizens, doctors, and community in a broader sense, to ensure that the information for a better Health Literacy is both widespread and effective.

Keywords

Apomediation
Health prevention
Health communication
Behaviour change
Empowerment

Well-being and behaviour change between design digitalization and resilience

1
Rappaport defines *empowerment* as a process by which individuals, organizations, and communities acquire greater control over vital issues (1987).

“How are design and medicine alike? These two fields are similar in many ways. Both are performed as an expert-informed skilled practice that is learned by doing. And both are informed by observation and feedback, by evidence of their beneficial effects. Both disciplines are motivated by a deep desire to help people manage and improve their lives, individually and culturally” (Jones, 2013, p.VIII).

Communication Design for Health and Well-being focuses on developing services, products and artefacts that promote greater health literacy of individuals to stimulate community empowerment¹ and resilience. More broadly, the term Medicine 2.0 and Telemedicine, can be used to refer to technologies, such as network communication, exchange platforms, tracking and simulation, designed to link doctors and patients directly. However, this approach needs to be better defined through a specific communication and mediation process that can: be the result of accurate context analysis and observation; be capable of enhancing the dialogue between citizens, healthcare facilities, and the territory in a broader sense within the Health Network; prepare the groundwork for a large-scale, yet mainly user-centred, sustainable design methodology; and use languages, digital technologies and immersive simulation systems (Gaba, 2004) that allow active involvement of the user. This discussion paper aims to highlight the paradigmatic evolution of the concept of health into physical, psychological, and social well-being. Therefore, it defines Design Disciplines as pivotal in developing an inclusive communication strategy to influence citizens' attitudes towards medical issues and their health-related behaviour.

The concept of Health goes beyond the idea of a mere absence of disease and includes a broader paradigmatic definition of well-being. As far back as 1948, within the Health Promotion Glossary (WHO, p.1), the idea of health was described as “a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity”. This explanation denotes a critical conceptual transition: from the centrality of disease to the centrality of health, since it shifts the focus from physical and biomedical aspects to cultural, psychological, and social factors.

In addition, the formulation of the WHO has paved the way for the multidisciplinary expansion of studies and approaches, and consequently of the research fields and related disciplines; among these, Health Communication (Kreps & Thornton, 1992) and Communication Design act by favouring the exchange of information, the relationship between different subjects and the mediation between additional interdisciplinary knowledge. Finally, the research focuses on well-being and health as relational concepts, dependent on the continuous exchange between individuals. This aspect is strongly determined by the social, cultural, and territorial context in which we live; therefore, design approaches for health must take these factors into consideration. Over the last few decades, and even more after the recent pandemic events, the conviction of a state of well-being reachable through a careful prevention and promotion strategy has

seen a constant development, moving beyond the physical boundaries of health structures, involving social actors in the community and encouraging daily changes in habits and lifestyles.

In this respect, digital information channels and new service technologies amplify this phenomenon of society's resilience². Despite their considerable potential, these technologies are also responsible for critical issues related to their use in this specific field. While the concept and definition of well-being change on the one hand, on the other hand, the attitude of individuals towards medicine and health evolves, also through digital innovations and the diffusion of digital networks and communities. Especially following the global pandemic, the phenomena of health e-community spread to the point of replacing the role of experts and contact with the local services, ensuring unlimited access to non-filtered knowledge and online equivalents of intermediated exchanges (González-Tosat & Sádaba-Chalezquer, 2021).

Mediation and Apomediation. New Approaches for Health-oriented Communication Design

Communication designers assume a pivotal role in mediation as a reorganization of contents and relationships³ (Castelli, 1996). In this regard, Eysenbach, in his speech *Medicine 2.0 Proceedings* (2008), introduces the concept of Apomediation⁴ referring to the evolution of the design approach to contemporary medicine. Apomediation activates a filtered exchange in a communication apparatus that effectively translates the complexities of the contents and the relationships between the actors involved. This definition contains a strong design mediation imprint beyond the simple contact and exchange of information. In other words, at the base of this network of information and relationships, the designer considers the physical and virtual channels (tools, languages, and devices) as points of contact and access to information. He interprets the needs of the actors involved and orients toward knowledge intended as health literacy. Therefore, in communicative terms, the designer, as a health mediator, translates a message into a context or space to ensure access to information, generating greater awareness, also researching contact points between the different actors who promote empowerment in overcoming vulnerabilities.

Hence apomediation is considered a dialogic term; it redefines the designer's responsibility as a bridge not only between doctor, patient, and researcher but above all between citizens, doctors, and community in a broad sense. In addition to reorganizing contents through accessible information, the codes, the languages, and the scripts of health communication are subject to change. In fact, even medicine uses experience to connect citizens with specific diseases in a network and increase their awareness, through a communication approach based on storytelling⁵ (Parrott, 2009). Since this is not only a medical-scientific concept and implies a strong social focus, health communication for prevention itself is called upon to consider a more qualitative and attentive approach to the individual's experience.

2

Baibarac and Petrescu (2019, p. 91) state: "We suggest that one way of sustaining and scaling local resilience practices is by developing digital tools that could enable connections and knowledge sharing across locations, through communing in the digital realm".

3

Castelli S. (1996) explains mediation as "realization of a relationship reorganization project" (p.5).

4

Eysenbach, G. (2008) distinguishes the concept of apo-mediation versus intermediation e disintermediation. "Apo-mediation means that there are agents (people, tools) which stand by (latin: apo-means separate, detached, away from) to guide a consumer to high-quality information" (p.6).

5

Parrott, R. (2009), professor at Pennsylvania State University and researcher of Health Communication, states that the process of communication should follow the Social Constructionist Models of Communication: built through the narratives of experience, direct or indirect, of reasons and pathways of health or disease. A promotional and empathic language considers the influence of perceptual aspects, thoughts, and emotions.

As part of the research on apomediation theory applied to communication design studies for health, criteria for case study collection were set up to define mediation through project examples. This process aimed to identify theoretical requirements to look for in existing projects, with the aim of not only achieving an effective mediation between the patient, the doctor, and the community, as explained above but also:

- Generating awareness, considering both personal health conditions and territorial health facilities.
- Promoting engagement and behaviour change, not only defined as taking care of personal health but also in terms of a sense of social relationship with doctors, caregivers, and the community
- Improving Health Literacy, helping people understand a specific medical issue, and providing accessible information, both direct and indirect.
- This analysis led to a wide range of case studies, mapped out and classified according to innovative and Responsive Technologies clusters.

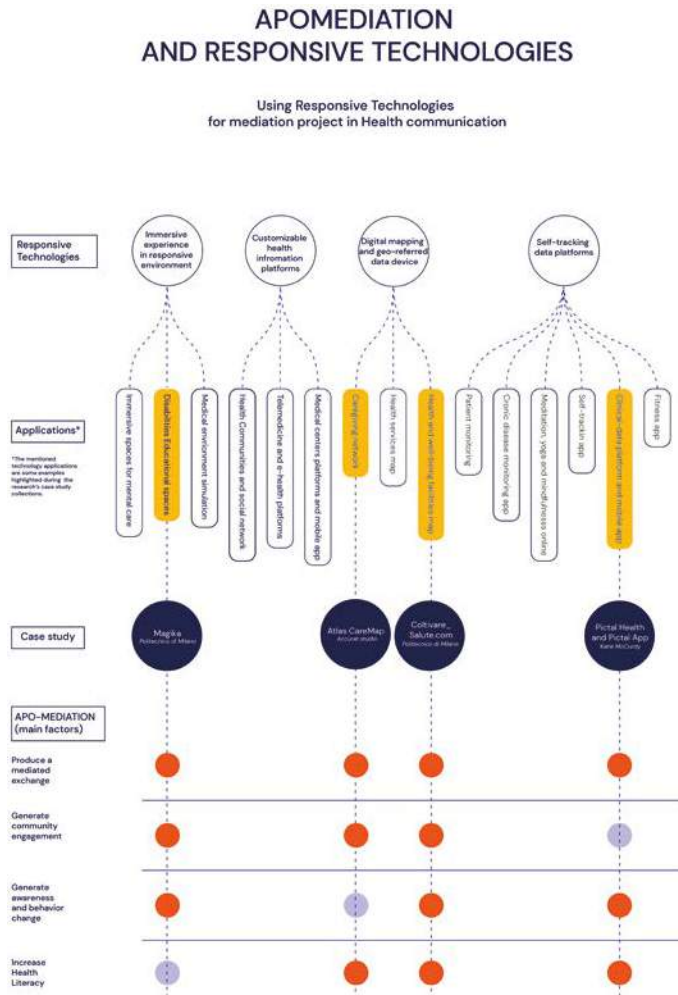


Fig. 1
Calabi D. & Maturò A. *Apomediation and Responsive Technologies*: Collected cases, classified according to innovative and Responsive Technologies clusters. Credits: Politecnico di Milano.

Apomediation approach through technologies

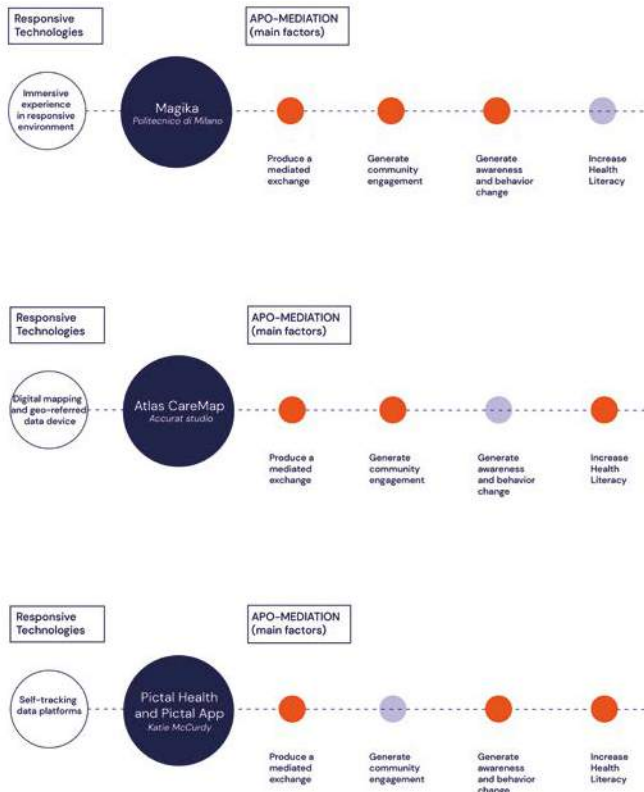
Using Responsive Technologies in the health communication field stimulates solutions for accessible prevention information, thus increasing awareness. Design is called upon to mediate between medical, scientific knowledge and the community of users, as a facilitator, monitoring the plurality of access points to activate awareness and engagement processes. More specifically, Responsive Technologies can help develop personalized health experiences thanks to their scalability and adaptability to the singular person or territory, through interactive responses, personal data, and geo-referred data, effectively strengthening individual understanding of clinical health conditions and the self-care prevention system.

These relational technologies do not isolate the individual but, on the contrary, place the individual in a relationship with the context, fostering mutual exchange and empowering people in the network, suggesting a step further into the definition of health concept: from the relational model to the network system. Finally, they play a crucial role in designing tools for the convergence of data and contents, usually not aggregated, and collected, for a more functional prevention communication.

Below are some project and research approaches that stress this design trend theorized up to now and implement apomediation strategies, exploiting digital technologies and reformulating contents to increase the empowerment of the directly involved individuals.

APOMEDIATION AND RESPONSIVE TECHNOLOGIES

Using Responsive Technologies
for mediation project in Health communication



- 1 Self-tracking system for health prediction. Atlas CareMap by Accurat studio. (source: <https://atlasofcaring.com>)

Atlas of CareMap is an interactive diagram that helps visualize connections and interactions of personal care and track the support ecosystem for families and caregivers. Thanks to digital technology and compelling visual language, it produces a mediated doctor-patient exchange, including caregivers. It collects data and information to produce engagement and network awareness.

Language: diagrams

Technology: digital mapping

Fig. 2
Calabi D. & Maturo A. *Apo-mediation and Responsive Technologies: Case study analysis of Responsive Technologies fostering an apomediation approach.* Credits: Politecnico di Milano.

- 2 Medical personal data interpretation and health-status visualization system. Pictal Health and Pictal App by Katie McCurdy. (Source: <https://www.pictalhealth.com>)

Using an infographics approach and data representation language, Pictal Health is a health-history visualization service that helps patients translate their symptoms into shapes to better communicate with doctors, developing more self-awareness regarding their personal health situation. A self-tracking data platform of mediation between patients and doctors.

Language: data visualization

Technology: online custom app

- 3 Simulated and immersive space for an interactive experience Magika by Politecnico di Milano. (Source: <https://ludomi.polimi.it/en/ludomi-welcome/>)

Magika is an educational service for children affected by intellectual disability, based on simulation technology for multisensory games and learning activities.

An immersive experience in the responsive mediated environment for educational purposes. It uses Responsive Technologies to stimulate children's learning engagement and generate behaviour change.

Language: visual and audio games

Technology: immersive space

Communicating a widespread socio-sanitary network: the case study of a project in Piacenza

The research illustrated so far is rooted in the context of the Polisocial Award 2020 project by Politecnico di Milano, Coltivare_salute.com. The project focuses on the central role of Case della Salute, polyvalent sanitary facilities in Emilia-Romagna, to foster community well-being and socio-sanitary resilience after the pandemic period. The specific contribution of the authors of this paper, as part of the Polisocial project, focuses on health prevention communication. The main objective is to carry out the territorial investigation to understand to what extent the community is informed regarding well-being opportunities of prevention and how the network in which the individuals are involved is perceived. To do so, collecting data on social and sanitary network relationships in the territory was necessary.

The first step of territorial exploration was carried out while also simultaneously analysing the existing communication system. Withing the identification of the facilities on the map through geo-rereferred data, we analysed the communication tools most frequently used by the sanitary and social actors. We then collected actors' opinions on how the community perceived the network and on what actions were carried out on the communication level.

Crossing the collected data, this process highlighted the need to change how the community perceives the Casa della Salute: more often as a simple facility rather than a central node and a reference point inside the well-being network of prevention. In fact, this network involves different social and cultural actors: organizations, working daily as a bridge between the clinical centres and the community to communicate prevention and health literacy; sports facilities committed to promoting physical activities for therapy and a healthy lifestyle; schools and cultural centres, encouraging well-being culture and risk awareness.

Specific evidence was collected as a result of this double investigation focusing on territory and communication. The richness of health facilities and well-being initiatives, scattered and spread out between the three districts of Piacenza, covers a wide range of services, affecting the territory in a widespread way. The territory's communication system does not always clearly express the health prevention network of well-being relationships and social collaborations: the sanitary network does not communicate in the same way as the social one. Hence, the community research for information appears to be quite fragmented. Thus, the necessity of developing communication guidelines for the Casa della Salute involvement in the network was identified.

To empower citizens with a higher degree of awareness, it is necessary to provide tools where they have the possibility to localize the actor in the territory, clearly see their connections and seek the information they need. This issue led to the second step of the research. Starting from the geo-localized data collected on an interactive map to better understand the facilities' distribution, we developed some informal questionnaires, to verify the active link and relationship in the network, involving some of the actors in the process. Clarifying the connections and making them visible represented the beginning of an apomediation process: the idea was to ensure that patients and citizens have access to territorial information through a communication system working as a collector.

As a result of these investigations, we developed some communication to promote health culture and awareness in the territory, using different media and displaying them in a cross-media system, including cartographical representation to visualize the territory, way-finding to orient the citizens and social media to foster engagement.

COMMUNICATING HEALTH CULTURE IN THE NETWORK Guidelines

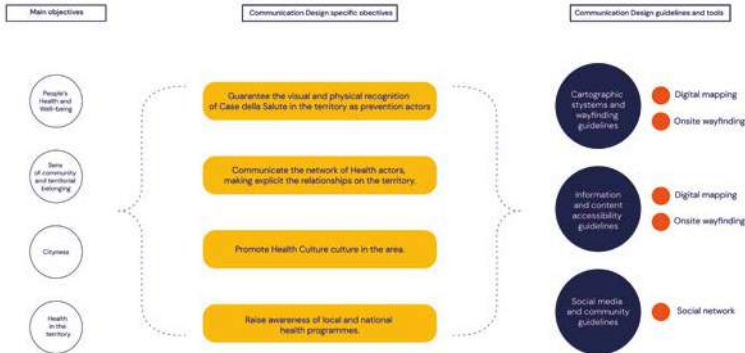


Fig. 3
Calabi D. & Maturo A.
Coltivare_Salute.com,
Communication Guide-
lines. Credits: Politecnico
di Milano.

The aim is to reach out and involve both sick and healthy patients, to engage people and increase understanding regarding the health opportunities in their local districts while also stimulating awareness on the importance of prevention.

The work focused on methodological guidelines for the representation of health and well-being networks in the territory, to make data and information accessible, thus improving community resilience starting from digital mapping. More on an experimental level, the communication guidelines assume the use of relational technologies as a starting point to facilitate health exchange and awareness in the network.

The research then led to some more experimental projects and a master thesis focusing on the actual application of the guidelines in the Piacenza context, to develop some digital mapping and social community artefacts.

Giada Zoncada's project explored interactive and responsive network mapping for a more Immersive visualization and orientation for people involvement.

COMMUNICATING A CAPILLARY SOCIO-SANITARY NETWORK *Interactive and responsive network mapping*

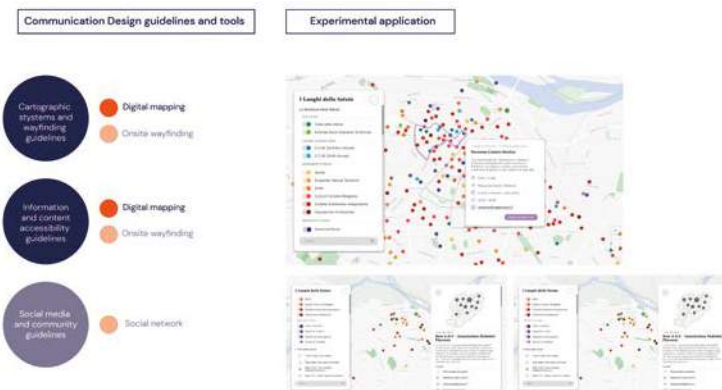
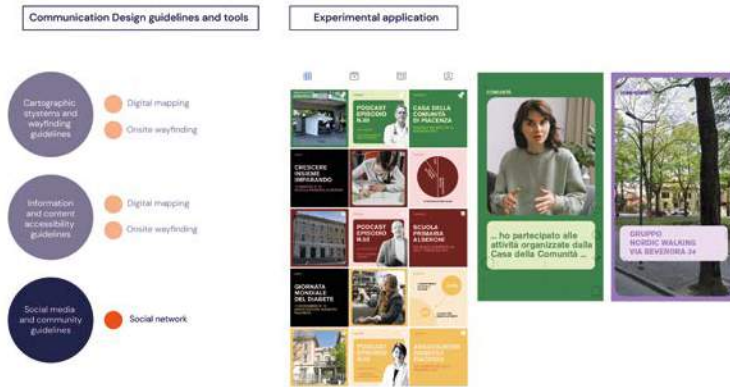


Fig. 4
Credits: Zoncada, G.
(School of Design, Politec-
nico di Milano).

Lucrezia Faraggi's project investigated the use of social networks as an effective tool to spread health culture in the community, by comparing international case studies in the sanitary field, and then developing an actual hypothesis for the area of Piacenza.

COMMUNICATING A CAPILLARY SOCIO-SANITARY NETWORK
Social network for Community Health

Fig. 5
 Credits: Faraggi, L.
 (School of Design, Politecnico di Milano).



Results and findings

If, as Eysenbach (2007) states, apomediaries “stand by and provide added value from the outside, steering consumers to relevant and high-quality information without being a requirement to obtain the information or service” (p. 162), thus the designer itself can act as an *apomediary*.

The ongoing project's main results focus on the definition of specific communication objectives and how to develop them through different media: guaranteeing the visual and physical recognition of Case della Salute in the territory as prevention actors; communicating the prevention network through mapping of the involved actors, making their relationships explicit; promoting prevention initiatives; raising awareness around health prevention issues and risks.

During the different phases of the research, a particular focus was placed on the methodological approach itself, which can later be applied to designing tools that are more than a simple medium. The adopted method is *apomediative* because it aims to be a mediation between citizens, services and the territory, filtering and verifying the information collected. By tracking the actual territorial connections, it was possible to make them accessible through the hypothesis of cartographic devices, which do not act as intermediaries but, in fact, guide and orient the citizen in the territory. A digital mapping service, supported by on-site wayfinding, can act as a mediation, providing a representation of a health and well-being network: it can translate a message into a context or space to ensure access to information, thus adding value and adapting to the network.

Therefore, the technological language is no longer a simple tool for action but the subject of study itself in design practice for effective apomediation, primarily referring to Responsive Technologies. Their potential lies in the possibility of adapting to a specific context, person, or territory, gathering innovative solutions able to amplify a mediation project. The risk lies in designing new intermediaries rather than *apomediative* devices.

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From Applications to Implications: Design as a Process for Humanising Future Robotics

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Abstract

The project *Signs of change seekers: Interaction and affectivity between robots and humans in 2030* set to develop strategies that promote a culture of active ageing, the identification of systems that promote positive emotional experiences, and the determination of possible ways for a more equitable society based on responsible innovation practices and future scenarios. The first phase of the project consisted of research, scenario conceptualization, and the definition of opportunities, while the second phase focused on validation, conceptualization of product-service systems, and rapid prototyping. The results of the project were three defined innovation paths where four product-service proposals were prototyped. The explored design process enabled a relevant change from a traditional problem-solving mindset (applications) to an opportunity-finding approach (implications), and presents the possibility of a creative vision from designers trained to impact strategically.

Keywords

Advanced design
Process
Well-being
Older adults
Affective robots

Introduction and Background

This paper presents the results of a collaborative project within the Mexican innovation ecosystems where technological development is traditionally led by applied research, the development of applications for scientific discoveries and technological advances. The usual processes of this applied research are linear. The starting point happens when a scientific discovery is followed by the search for technological applications. In this pathway of innovation, design intervenes at the final stages, where the applications of the technologies developed are already defined and the role of design is on the appearance and functionalities of the product.

The project called *Signs of change seekers: Interaction and affectivity between robots and humans in 2030* is coordinated by the Futures Design Lab of Tecnológico de Monterrey university. It was proposed as an opportunity for multidisciplinary collaboration between researchers on robotics and artificial intelligence, technology transfer officers, Design Researchers and design students.

Through an action research process and case study documentation, this article describes the test for the hypothesis that design can contribute in the early stages of a process in the search for opportunities where technology can be a means to wellbeing. The hypothesis was set in the particular field of the population of older adults, where active ageing and equality turn fundamental for responsible innovation. Design processes and tools such as scenarios, interaction design, persona building, and giga-mapping can enable collaboration in the innovation ecosystem (technological research, technology transfer offices, and design) to drive technological innovation towards wellbeing. The case study is set in the context of Tecnológico de Monterrey's innovation ecosystem, where design practices are a catalyst of dialogues and processes for humanisation, inviting stakeholders to think about what can be done along the social transformations implied by their agency. The process was designed to focus on results that will impact the physical and emotional care for the generation that will be older adults by the year 2030 in Mexico.

Designers have turned to affective design strategies to allow for an emotional bonding. The products of affective design are proven to entertain people and to provide certain cognitive activities, but evidence lacks about their usefulness for socialising, companionship or physical therapy (Van Aerscht & Parviainen, 2020). A connection with a synthetic being requires the impression of human life more than the anthropometric features of a human body. The conditions for this connection include "visual similarity, speaking and kinesthetic skills, emotional, social, and cultural intelligence" (Viik, 2020, p. 63).

Robotic assistants for older adults should aim to prolong their independent living and to aid caregiving at home and at medical care facilities. A robot to care for older adults in home environments is expected to provide assistance with daily living, cognitive support, and social interactions. At a medical care facility, the expectation is to provide support for caregivers and medical triage (Van Aerscht & Parviainen, 2020). Home robots are designed "to induce in the user strong feelings of attachment, bonding, and protection, thereby

setting up the ideal conditions for companionship and care”, but they should also address other concerns about the user’s best long-term interest such as information privacy (Lacey, 2019, p. 378).

This project is supported by advanced design practices; and, as such, practitioners are required to develop the competence to conduct design research, where they can systematically develop new knowledge that can have an effect on people’s perception and values (Celi, 2015). The stakeholders must be able to gather knowledge and experiences to solve systemic and multidisciplinary problems. This represents a relevant cultural transformation into a more advanced design culture where the framework of the project becomes extended (Iñiguez et al, 2019), searching for longer-term solutions in an extended time horizon and a broader set of disciplines, and increasing the expertise and methodologies applied into the project. Therefore, the stakeholders set out to develop the following competencies throughout the design process:

- To identify the existing theories in a multidisciplinary field to develop grounded future scenarios and concepts for a specialised audience.
- To develop strategies for the analysis and synthesis of information to communicate future scenarios and its possibilities.

In addition to the development of advanced design skills, some other objectives of the project were the construction of future scenarios that promote a culture of active ageing, the identification of systems that promote positive emotional experiences (León & Michel, 2017), and the determination of possible ways to promote a more equitable society based on responsible innovation practices.

Methodology

Cely (1999) remarks that there is no single method for obtaining scenarios, and the qualifier is assigned only to those studies that take into account the analysis of the phenomenon under study from a retrospective and current point of view. This analysis considers the influence of the social groups responsible for the development of the phenomenon, as well as the factors of change. Following this approach, the project’s development was structured iteratively according to the following general phases:

- 1 Assessment of the current context.
- 2 Analysis of the variables relevant to the emphasised topic.
- 3 Trend assessment.
- 4 Identification of signals of change and key variables.
- 5 Determination of relationships between variables and their hierarchy.
- 6 Proposal and study of future scenarios.
- 7 Identification of opportunities and definition of challenges.

The project was developed through work and discussion sessions, documented in a gigamap. The gigamap is a visual resource that enables the construction of a shared and collaborative narrative of research and analysis. With this tool, the dynamics to stimulate critical thinking and the management of complexity are set. These dynamics involve ongoing discussions about the system’s characteristics, as Godet (2007) suggests. These include the time

of anticipation, which entails considering possible and desirable changes, and the time of proposals, involving the development and evaluation of potential strategic options to prepare for the anticipated changes.

The Project

The project was organised in two phases a year. The first phase consisted of activities related to research, scenario conceptualization, and the definition of opportunities Fig. 1. The second phase focused on the validation of previous research, conceptualization of product-service systems, and rapid prototyping Fig. 2.

The research process used tools from Advanced Design to inquire trends and signals of change within the defined context of study. The analysis allowed for the creation of scenarios, innovation opportunities and the development of models to support the wellbeing of older adults.

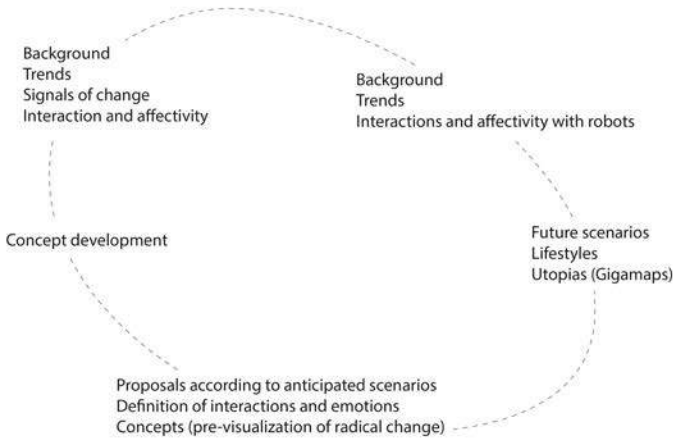


Fig. 1
Phase 1: Research, conceptualization, and opportunities. Stages and main activities from the stage included trends analysis, proposing signals of change, gigamapping, and developing concepts to the anticipated scenarios. Credits: Authors.

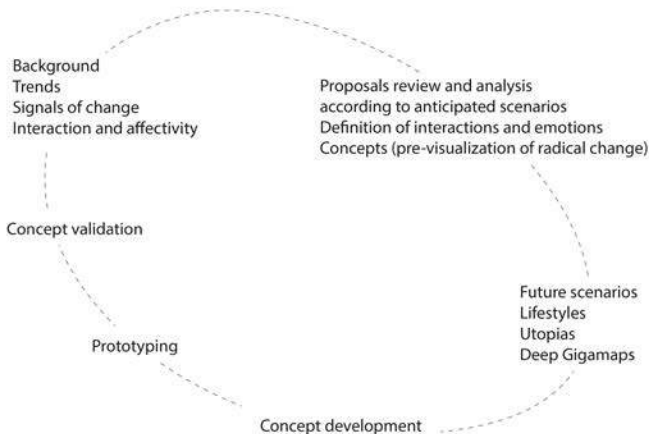


Fig. 2
Phase 2: Validation, conceptualization, and rapid prototyping. The second phase considered a review of the opportunities identified in phase 1, the reformulation of future scenarios and the prototyping of new product-service platforms. Credits: Authors.

Results

The giga-maps from the first phase represent a system that reaches particular conclusions along each thread and propose innovation pathways centred on the wellbeing of older adults in the year 2030. The approach to scenarios helped determine the attributes of future product- and service-systems within the scope. A detailed view of some of the generated giga-maps can be found at <https://sites.google.com/tec.mx/designandresponsivetech/>.

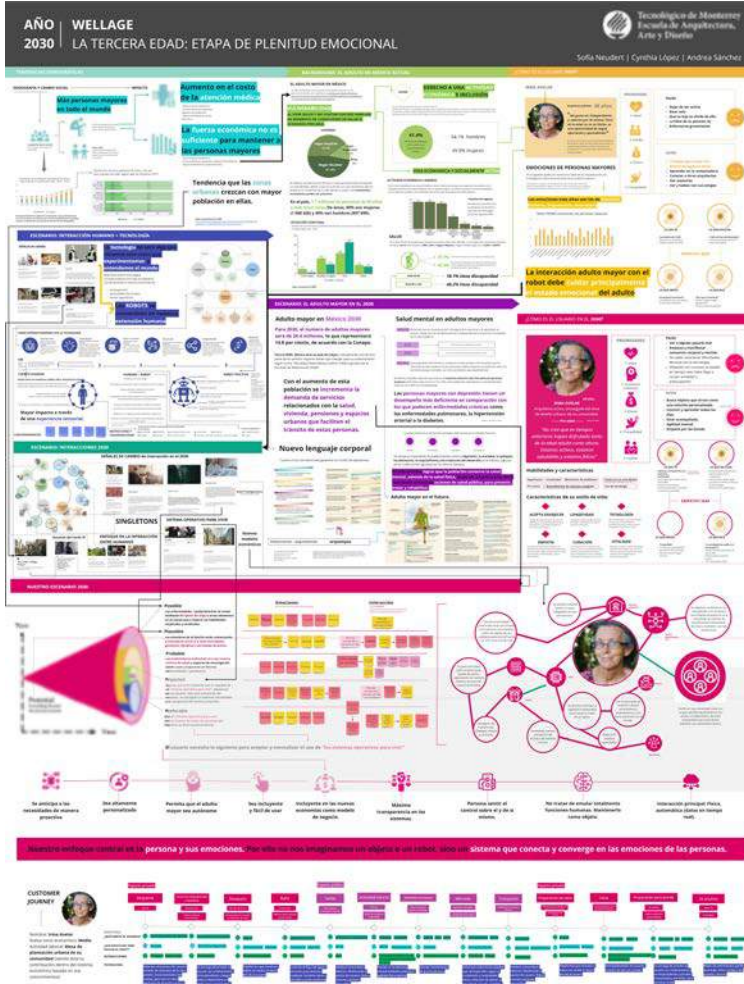


Fig. 3 Design team elaboration. A giga-map resulting from phase 1. In the giga-map, the design team explored opportunities for the future through the identification of key drivers, projecting a future user and identifying her future needs.

The exploration along the giga-map helped to inform a future user persona and to project her customer journey in the private and public spaces, exploring her interactions with future technologies and her emotional responses to them. For this scenario, a set of innovation paths was defined and three of them gathered most of the attention from the stakeholders.

TABLE I. INNOVATION PATHS
Path 1. A focus on healthcare facilities and research centres to care for new and prevailing ailments and diseases.
Path 2. A highly customisable living operating system that supports an older adult in everyday needs, preferably attainable by everyone regardless of their economic condition.
Path 3. Family members holistically understand themselves, aided by data gathered by technology.

Each of these innovation paths presented specific opportunities to develop future products, services and systems. A set of requirements for these future solutions was defined. Examples of these requirements are:

- Proactive anticipation of user needs.
- Personalization or customisation.
- To provide autonomy for the older adult.
- Inclusive and easy to use.
- System transparency and control.
- Machine-like rather than human-like.

When presented with these findings, researchers were particularly interested in the potential that these paths meant for their future work in robotic systems, artificial intelligence and Internet-of-Things. The collaboration and the validation of results with the research group revealed that designers needed to strengthen their ability to analyse scientific contents to develop foresight products that capture the interest of researchers. This insight guided the planning stage of the second phase.

The second phase began with a selection of opportunities to explore further. The results from previous research were validated to support design decisions of product- and service-systems based on affective robotics.

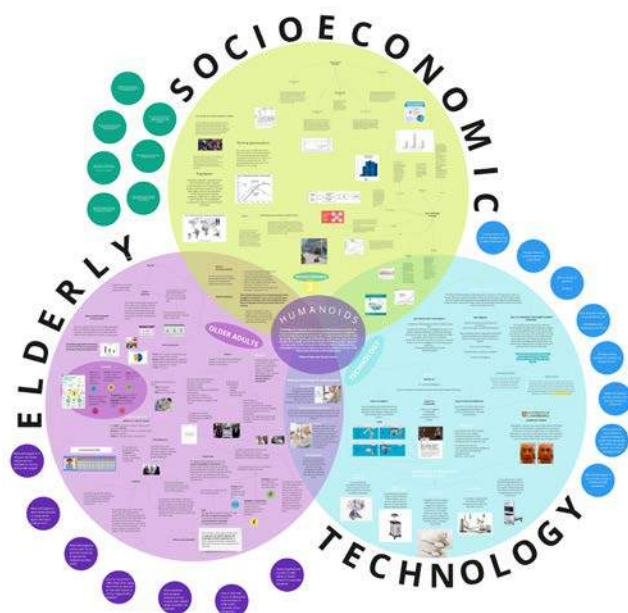


Fig. 4
Design team elaboration. Giga-map from the early stages of phase 2. In the reinterpretation, the design team identified design criteria that needed to be met as functions and characteristics of future products.

The challenge was met with collaboration from experts and the use of tools such as a PESTLE analysis and Technology Roadmapping. Some participants included video resources in an interactive giga-map, resulting in a challenging codification effort. A last challenge was the traceability of information within and between project phases.

The selected process and tools were intended to spark conversation among participants and researchers. The next image shows the comments and discussion directly on a giga-map. Along with the comments themselves, patterns of interest also emerge.

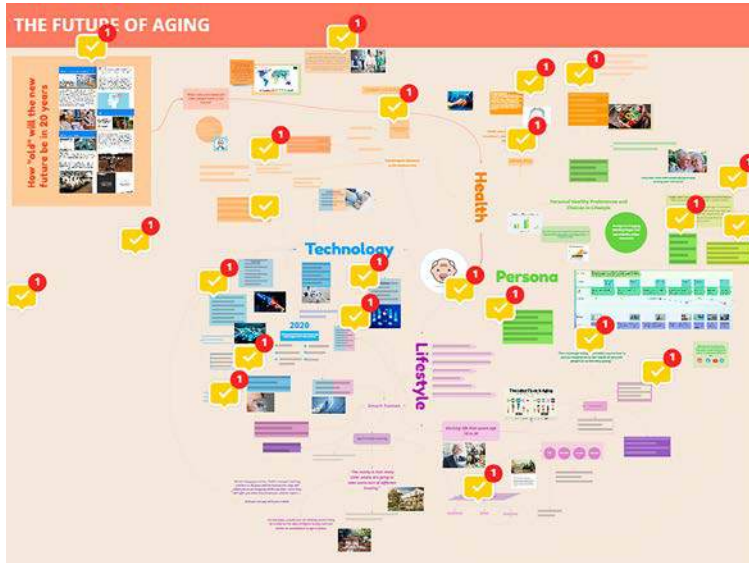


Fig. 5 Design team elaboration. Comments and discussion in a giga-map. Collaboration and discussion was enabled by technology in a hybrid work-format.

The process and the interests from the design team led to a set of potential future products and systems in two of the innovation paths from phase 1.

Path 1. A focus on healthcare facilities and research centres to care for new and prevailing ailments and diseases.	Smart full body scanning to support nursing practices Telemedicine station Portable smart nursing station
Path 2. A highly customisable living operating system that supports an older adult in everyday needs, preferably attainable by everyone regardless of their economic condition.	Smart assistants and care-robots at home to: <ul style="list-style-type: none"> • Preserve mental health • Promote physical activity • Promote healthy nutrition • Promote healthy habits • Prevent injuries in daily activities

The results of the project show that, through the strategies and the structure of the process, it is possible to develop competencies that prepare designers to explore solutions to the challenges of complex problems in future scenarios. The social value is not only in the prototypes developed, but in the process itself that allowed future designers to identify possible strategic and sustainable paths to transition, wellbeing, and a culture of active ageing.

After the presentation of prototypes, the researchers were especially interested in the possibilities of a smart full body

scanning to support nursing practices. The use-case, the interactions, and the integrated technologies inspired them to further the development of a product-service that will improve public health conditions for older adults in Mexico. Also, a special mention goes to another of the resulting prototypes, called *Tiliche*, awarded first place in the *Diseña México 2021 Award* in the category of hardware design for electronic devices.



Fig. 6 Design team elaboration. Phase 2 summary for the award-winning prototype *Tiliche*. Interactive gigamap of the transition to the year 2040.

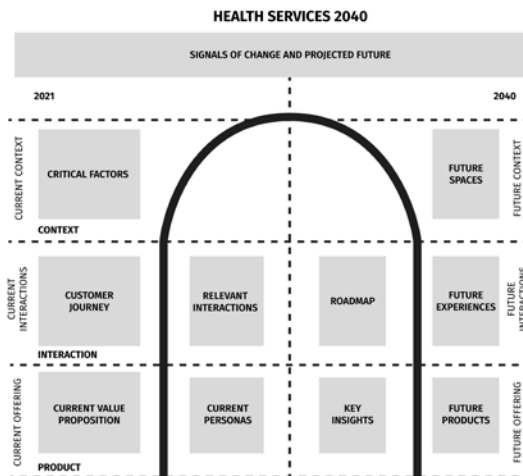


Fig. 7 Analysis of the content in the gigamap for Figure 6 to develop a new product offering for the year 2040. Credits: Authors.

The design team behind *Tiliche* explored Path 2, proposing a living operating system (LOS) to promote healthy habits and preserve the mental health of older adults. *Tiliche* is a platform that anticipates the user's active ageing needs and promotes her autonomy in a fun and easy-to-use way.

Discussion

A shift from the traditional role of design in technological ecosystems is possible. Design is traditionally used as a tool for new product development (NPD). A more strategic role for design, where its processes and tools are set in the earliest stages, is a relevant change in the innovation pathway at the Mexican technology arena. The design processes and tools were enablers of a relevant change from a traditional problem-solving mindset (applications) to an opportunity-finding approach (implications).

This relevant shift allows the different stakeholders of the project to have a broader perspective on the possibilities of the innovation process, and to explore innovation opportunities together with a more user-centred process. Rather than a technological-push approach, the design process gives the opportunity to keep focus on the notion of wellbeing at the centre, instead of having the technological application itself as the main objective of the project.

Conclusions

Designers need to develop the competencies for applying tools focused on societies and collective systems that promote a sustainable development from a perspective that considers:

- The present as an analysis tool that validates past decisions.
- The future as an approach to desirable scenarios.
- Anticipation as a design tool that transitions between the two to reach a goal of collective wellbeing within technological development.

Emerging challenges are ever more complex. A creative vision is required, from designers trained to impact strategically beyond enterprises, organisations, and new urban models. Technology ecosystems can take advantage of the design processes in a more strategic way, transforming the traditional linear approach into a more organic and transdisciplinary environment.

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Mixed Reality as Activator of Collaborative Processes for Transcultural Future

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Abstract

The contribution aims at outlining the impact of Mixed Reality devices in the communication and fruition of cultural heritage, as engine for the change of reciprocal relations between space, object and visitor, towards a transformation of the visit experience as an opportunity for user involvement. Hybrid technologies turn physical spaces into phygital, as immersive and narrative places, stimulating proactive processes that can stratify multivocal points of view. Through case studies, based on the level of integration of digital devices in the physical space and the interactions generated, the paper extrapolates the characteristics of the language triggered by Mixed Reality, underling a renewed centrality of the body gestures in inhabiting behaviour. The cultural spaces of the future are defined as embodied places, able thanks to the structural use of hybrid technologies, to push the collective intelligence and the polyphonic vision of tangible and intangible cultural heritage.

Keywords

Mixed reality

Phygital spaces

Tangible interactions

Interactive storytelling

Body gestures

Cultural Heritage Experience and Hybrid Technology

The increasing presence of digital media in the cultural field animates the debate related to a change of approach in the ways of living cultural heritage, exploiting the interdisciplinary perspective of design methodology to deepen the penetration of hybrid technological devices as means of communication, but above all of active involvement of visitors in the cultural process.

The impact of the technological approach within museum spaces has led to a change at different levels of the experience of cultural heritage, transforming the reciprocal relationships between space, artefact on display and visitor, within a liquid museum dimension, open to display the socio-cultural transformations, starting from a vision open to innovation of the cultural heritage itself. In this perspective, the use of multimedia devices is framed towards a multimodal approach, conceived on the one hand as multivocality of the points of view displayed, and on the other as the involvement of the visitor in a dimension of simultaneous stimulation of different senses (Bollini, 2001), capable of modifying the museum proxemics toward a *performative museology* (Trocchianesi, 2014).

The use of digital technologies moves in a direction of hybridisation of cultural spaces, defined as *hybrid* (Benford et al., 2009; Waern & Løvlie, 2022), *blended* (Lange et al., 2019), to the dimension of *phygital* (Borsotti, 2022; Debono, 2022; Carella et al., 2019; Nofal et al., 2017), as an open dialectic between real and digital space (Debono, 2022), in which the physical is mediated by technological devices within the ICT, as to prompt new “perceptive experiences [...] configured through the physical and active involvement of the visitor, who acts, therefore, as a sort of *relational trigger*” (Borsotti, 2022, p. 449). The topic of *phygital*, developed in the context of marketing, is re-contextualised in the field of cultural heritage, emphasizing how the exploitation of the material dimension of the space and artworks on display could be designed through the overlapping of *seamless* technology (Claisse, 2019), capable of staging the awareness of the immaterial dimension of what is visible. This approach implies considering the strong link between digital technology and the physical world, amplifying the emotional value of the physical objects on display through the narrative and interactive capabilities of technology. In this sense, the focus is not only on the technological advancement itself, but more on the design of the visit experience, through digital technology, starting from the motivations and background of the visitors.

In the dimension of *phygital* spaces, the synergy between material and digital components leads to a more powerful experience of materiality, pushing towards a wider gestural interaction, which breaks the traditional space-time coordinates of fruition (Bollini & Borsotti, 2016; Lupo, 2021). Therefore, technology becomes activator of bodies, pushing to the involvement of the visitors, in a dimension in which museums act as *sensescapes* (Grechi, 2021), moving from a vision-centred to a bodily perception experience. Referring to body involvement is framed as the need to understand cultural heritage through the re-contextualisation of gestures, as if to say that not all artworks are comprehensible only through vision;

however, this is possible by considering the body as a more complete form of making sense of the external world (Candlin, 2004; Merleau-Ponty, 1945; Pallasmaa, 2009), understanding the own position through the encounter with the other (McLuhan, 1969).

The potentiality of the design of hybrid space starts from the consideration of the evocative capacity of the physical space and thus the importance of feeling the material dimension of the physical experience of museum (Cicerchia & Solima, 2021), as perception of collective moment; on the other hand, the encouragement to establish a deepen relationship within the museum spaces goes in a direction of a change of status of museum, beyond a templar dimension towards an openness of the collections. Thus, the new definition of the museum as provided during the 26th ICOM Extraordinary General Assembly in Prague clarifies this process, updates the previous one of 2007, emphasizing the centrality of the fruition of “varied experiences” (ICOM, 2022), through the participation of the communities. This objective is strongly linked to a cultural proposal that gives voice to the different positions that emerge in the contemporary world, representing a meeting place, where to show the *invisible*, the *ordinary*, the *unspeakable* (Borsotti, 2019).

Technology pushes the process of opening up museums to an experiential perspective (Balzola & Rosa, 2012) as laboratory of change, transforming the museum visit into a possibility to live at different levels a widespread sociality, participating in the enhancement of the cultural heritage. This approach starts from the consideration that the involvement of the visitor in the cultural process can on the one hand stimulate a collaborative dimension, in an intermediate between *contributive*, in which visitors are stimulated to contribute with their own point of view, but without being able to change the course of the exhibition, and *co-creative* as the management of the whole process (Simon, 2010). Collaboration is understood as an emotional involvement such as to put the visitor in a mental condition to consider the artwork as a triggering process of a *transformative experience* “that support spontaneous, meaningful “re-seeing” of the world in service of self-relevant, personal growth-oriented activities” (Garner et al., 2016, p. 342). In the collaborative processes, the participation of visitors, through physical involvement, becomes part of the exhibition (Trocchianesi, 2013), transforming the space into a dimension in which the performativity of interactions, driven by technology, dynamically implements the narrative linked to the space and the artworks on display. In this sense, the fruition of cultural heritage moves towards a dimension of *transculturality*, as the visitor experience the valorisation of its own cultural condition starting from the experience of the others.

Mixed Reality: technology, narrative and body involvement

The Mixed Reality has a central impact in the construction of hybrid spaces, as a dynamic relationship between the digital and the physical space, conceived as *assemblies* (Hornecker & Ciolfi, 2019, p. 29), in which the extended dimension of the digital into the physical ushers in different possibilities of experience: on the one hand, the



Fig. 1

Fig. 1
Ett spa, Ara as it was, Ara Pacis Museum, 2017. The visitor, through the use of Samsung Gear VR, overlaps on the existing context the previous coloring © Ett spa/Gruppo Scai



Fig. 2

Fig. 2
Ralph Appelbaum Associates, Lavazza Museum, Turin, 2018. The relationship between visitor and the cup in the Universe space © Andrew Lee

dimension of the hybrid space as a condition of fragmentation and hypertext, as to break the sequentially towards the logic of association (Trocchianesi, 2014), on the other hand, the hybridization as the design of *continuous trajectory*, an engaging path, in which “trajectories appear to be continuous, extending backwards in time to reveal a coherent history of experience, and forward in time to suggest anticipated routes and possible future actions” (Benford et al., 2009, p. 711).

Mixed Reality is defined as a *continuum* between the extremes of the real and virtual dimension (Milgram & Kishino, 1994), enhancing the characteristics of physical reality and the virtual world. In this sense, Mixed Reality devices exploit the multiplier capabilities of technology, providing more and more customizable, immersive and variable information; on the other, Mixed Reality is defined in a link inseparable from the physical context, defined as situativity, but also in the intrinsic quality of the devices to stimulate the action of the user, as the affordance (Gibson, 1986).

Considering the relationship between these two variables, situativity and affordance, it is possible to mark a scheme of interactions between the agents in the field, the space-object, the technology and the visitor, in the model of *phygital heritage*. On the one hand, it outlines an *augmented technology*, as visible and recognizable information layer, which overlaps with the physical space, through the use of tools such as wearable devices, in which a communication is established between a physical device and space, activated by the user; on the other hand, in the *integrated technology*, the interaction takes place between the space-object, in which technology is merged, and the visitor, in an invisible dimension of technology, which is only actionable by bodily involvement, towards a possible dimension of *actuated technology*, as interface shaped directly by the users (Nofal et al., 2017). The dimension of *integrated technology* is defined above all by the concept of *tangible interactions*, as an all-encompassing sensory experience, through which to amplify the intangible dimension of cultural heritage (Duranti et al., 2016), in a simultaneous design of the technological devices and storytelling (Petrelli et al., 2016). *Tangible interactions* are declined in the dual binary of *embedded and embodied interactions* placing the attention in the interaction with the digital system in a case on smart objects, through the use of an invisible technology integrated in the artifacts, and in the other on the bodily gestures of the visitor, as to represent a means to multiply the levels of interpretation of the narrative and amplify the intangible value of cultural heritage. These relationships can be defined in different categories, as *smart replicas* and *originals*, *symbolic objects*, *codified gestures* and *performing gestures*, to decipher from the physical materiality of the object the agency delegated by the designer to achieve the interaction (Duranti et al., 2016).

The invisible dimension of the technological structure is functional to make the interaction spontaneous, in a dimension of daily gestures, which make the relationship with the cultural heritage close, as a friendly encounter. The concept of *natural interfaces* develops as a possibility of a family relationship with technology, since it is deprived of visible systems, is reported in the sphere of ordinary sensory gestures (Bollati, 2021).

Case studies

Considering the definition of Mixed Reality and the delineation of *phygital* spaces as places for narrative interactions, we can consider four illustrative projects that mark the progressive transition from the visible dimension of technology, through the use of wearable devices, to the technology integrated in smart objects and sensitive environments, as dimension of interactive, collaborative storytelling through the bodily involvement of visitors.

The Ara as it was: the space between physical-virtual dimension

Inside the *Ara Pacis Museum*, the project *the Ara as it was*, designed by ETT spa, tells the origins of Ara Pacis and the foundation of Rome, through the use of Virtual and Augmented Reality. Wearing Samsung GearVr, visitors could be transported in a multisensory journey, through nine POI, moving between a real physical dimension, superimposing on the existing architectural context its original coloring Fig. 1, and a virtual dimension, bringing visitors to the discovery of the ancient Campus Martius, flying over the area and feeling immersed inside a sacrificial ceremony, led by Augustus Emperor. The technological layer breaks the barriers of traditional gestures, as a chance to experience a physicality other than that of real space.

The interaction between the space and the visitor is mediated by a wearable device, which, in the context of Mixed Reality, allows to have diversified and immersive information, using physical space as a support for digital content, amplified by a story between reality and virtuality.

Lavazza Museum: Can you feel the power of an object?

What could be an object that in the collective imagination represents the most emblematic symbol of the ritual of coffee, if not the cup itself? The path inside the *Lavazza Museum*, designed by the Ralph Appelbaum Associates with creative multimedial project by NEO and Tamschick, is guided by a smart cup, which the visitor receives at the beginning of the exhibition and which represents the unique tool to activate the installations, save, capture the moment and take it with after the visit, using RFID sensors. Fig.2 The topic of tangible interactions is declined in the enhancement of smart objects, as capable of articulating an intimate and emotional relationship with the visitor, as a filter of contents, which allows to customize the visit, never making it predictable a priori. The journey unfolds in 5 areas: Casa Lavazza, the history of the brand; the Factory, the production process; the Square, its iconographic contextualization and enhancement of the ritual of the coffee; the Atelier, where meet the characters and collaborations of the brand, up to the Universe, as immersive experience. The project represents the possibility of experimenting in the intimate relationship with the cup object the gestures found in the memory of the visitors of the coffee ritual, allowing the technological interaction to be mediated by the relationship between the visitor and the object, as an introspective act, but also of sharing the moment with others.



Fig. 3

Fig. 3
Studio Azzurro, Nobody is normal, up close, 2012. Feel the closeness of the stories as in the gesture of holding by the hand © Studio Azzurro



Fig. 4

Fig. 4
Nobody is normal, up close, 2012. Detail of interaction © Studio Azzurro



Fig. 5

Fig. 5
Migliore + Servetto, ETT spa. A world of Potential, 2021. Machine of the teamwork, multimedia installations are activated thanks to the simultaneous movement of visitors ©ETT spa/Gruppo Scai

Nobody is normal, up close, what if it was you?

The immersive exhibition of the *Museum Laboratory of the Mind*, set up by Studio Azzurro inside the former Pietà hospital in Rome, is an interactive itinerary that tells the story of mental illnesses and their social and institutional perception. *Entering outside, Exiting inside* is the key to experience the multimedia narration, animated by the gestures of visitors, as an invitation to meet diversity, entering into the spatial and emotional context of mental hospitals. Through the succession of sensitive environments, visitors perceive another world, identifying with the rituals and everyday problems of patients, deepening their perspective. Visitors talk, look, listen and move to activate the installations. An object, like a bowl, speaks through multimedia images, only at the touch of the visitor (UOS Centro studi e ricerche ASL Roma, Studio Azzurro, 2010).

In this context, *Nobody is normal, up close*, within the Cencelli Library, as a narrative epilogue of the second floor of the Museum Laboratory of the Mind represents a moment of intimate encounter with patients: along the wall, the protagonists of the stories are walking. The visitor can listen to the story only by touching the image, dragging it with him, as in an intimate and familiar gesture. Is there a more connected gesture than holding hands? The space-time coordinates are broken, there is no time, there is no space, there is a place that was other and that is now in the dimension of the physical encounter. Fig. 3, 4

The physical involvement of the visitor is the engine of the set-up mechanism to know the diversity, living it in first person, but it is also the object of the exhibition, in a reversal of the traditional relations between object-subject, reversing roles and exalting ritual gestures as the object on display.

*A world of Potential: interactive machines,
collective relationships*

A World of Potential, the interactive exhibition within the Procuratie Vecchie, as the headquarters of The Human Safety Net in Venice. The exhibition - set up by Migliore + Servetto, curated by Orna Cohen and Andreas Heinecke of DSE, Dialogue for Social Enterprise, with multimedia and technological project developed by ETT spa - offers visitors an immersive and interactive experience to understand their personal potential, exploring their character strengths, punctuated by the Values in Action method of Martin Seligman and Christopher Peterson, through a path that leads from an introspective to a collaborative vision.

The exhibition has been articulated in 16 interactive machines, which develop into a hybrid dimension of space, according to a sequence of experiences, moving along a path that guide the visitors to discover their potential, starting from the empowerment of their values. The potential is unhinged from an introspective point of view such as in the perseverance machine, where measure the concentration through a band with sensor, connected to a vertical tube in plexiglass. Only those who manage to stay focused will see a polystyrene ball climb up the tube. The power of collaboration is

enhanced through installations, that can be activated only by interacting with others, as in the machine of teamwork, in which only by coordinating, through 4 stations, it will be possible to be immersed into the multimedia contents of the interactive table Fig. 5. The power of social engagement is declined in the physical encounter with the alter ego of THSN that is compatible with the characteristics of the visitor.

Through the exhibition it is possible to emphasize the presence of a technological mechanism aimed at the implementation of the introspective and relational capacity of visitors, called to use the interactions staged by the machines as a vehicle of polyphonic content, conceiving space as a place of collective relationships in which, albeit in moments of individual approach, feel connected to the potential of others.

Conclusions

The evolution of the physical cultural spaces into *phygital*, through the use of Mixed Reality, opens to a perspective of innovation in communication and fruition of cultural heritage, linking technology, narration and body, as three components of the same superstructure that orients the relationships between space, artifact, and visitor.

Technology aims at enhancing the role of the gesture as stimulating relations in space, using behavioral patterns closer to the world of everyday life, through *natural interfaces*. This possibility promotes the physical frequency of the museums, amplifying the materiality of the physical space through the use of tangible interactions, that stage the evocative power of smart objects and the value of user gestures as activator of content. Through the use of multi-sensory devices, it is possible to manage polyphonic points of view, offering the visitors the awareness of their role in space, in relation to themselves and others.

The perspective of the museum as an embodied place means stimulating the evocative capacity of cultural heritage, using the hybrid technologies of Mixed Reality as a perspective of awareness of the complexity of the narrative, placing the visitor in a condition of bodily stimulation such as to relive rituals and gestures capable of going beyond the thresholds of the own perceptual and cultural coordinates, through the interweaving of the own trajectories with the others visitors.

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Sustainable Data-Driven Strategies and Active Well-Being: A Case Study

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Abstract

Nowadays the world is characterized by an increasingly aging society. This phenomenon represents a risk for the sustainability of the healthcare system. One of the factors that can accelerate the consequences of the aging process is sedentary behavior. Currently, there is a large availability of wearable smart devices and mobile applications, that can collect data.

However, some social and functional problems were observed, therefore we believe that there is great room for improvement (Mincolelli et al., 2018).

In addition, the paradigm of the Internet of Things is enabling those applications to share data with other programs and smart devices, which, in turn, can generate an ecosystem of services that can improve the quality of life, not only of the single user, but of many groups of a determined social context.

The contribution presents a case study (PLEINAIR project) that focuses specifically on the development of Human-Centered outdoor smart technologies that can adapt themselves to the necessities of people of all ages and abilities in order to encourage them of taking care of their health.

Keywords

Internet of things
Active well-being
Human-centered design
Health data
Self-tracking

Introduction

Many communities and governments around the globe are increasingly paying more attention to people's well-being because it is an essential value for policy-making, due to its significant impact on economic, health, social and cultural facets of life (Adler & Seligman, 2016). Physical activity is one of the most important elements contributing to enhancing positive benefits on well-being, including physical and psychological health (Biddle & Ekkekakis, 2005). However, rapid technological and social advances in modern society are causing radical changes in people's lifestyles, influencing their behaviors, increasing the time they spend staying still in front of a display, causing poor participation in physical activities.

Several multiple cultural and environmental factors – such as high urbanization, including urban pollution and congestion, shortage of green parks or pedestrian walkways, inaccessibility of sports or leisure facilities (Gupta & Bansal, 2020; Park et al., 2020), and misusing of technologies (Barnett et al., 2018; Fennell et al., 2019) and aging population (Aguar & Macário, 2017) – are contributing to adopting a sedentary lifestyle, which is negatively affecting economic assets and welfare of many countries (ISCA, 2015). As reported by WHO (2020), around 30% of the global population – one in four (27.5%) adults and more than three-quarters of adolescents – engages in insufficient physical activities (Bull et al., 2020; Park et al., 2020). Additionally, recent phenomena caused by the Covid-19 pandemic, such as social distancing, smart working and self-isolating, exacerbate this trend (Zheng et al., 2020). For this reason, it is crucial to reduce sedentary time as much as possible to decrease its negative health impact on society.

Active well-being: to cure to care

Considering a behavior can be influenced by a series of individual, social and contextual factors (Sallis et al., 2008), effective interventions at the environmental level (the city) determine more opportunities to trace a new urban model (new set of behaviors) that enables citizens of all ages and abilities to be physically active day-by-day (Edwards & Tsouros, 2008; Krupat, 1985). In this perspective, the concept of the active city or healthy city emerges as a new cultural paradigm capable of fostering an enabling built environment that encourages the use of the body in everyday life through equitable access to urban public spaces (Dorato, 2020).

In this term, that strategy can transform the curative and medicalized idea of health into a preventive approach that enables citizens to grow consciousness around the benefits of taking care of their bodies and adopting active behaviors (Dorato, 2020).

IoT, data, and new smart citizens

In that new socio-ecological scenario, the Internet of Things has the opportunity to foster active well-being by encouraging citizens to engage in physical activities where data themselves are utilized as

a raw material for producing new design strategies (Zannoni, 2018). This helps to generate new adaptable and inclusive urban spaces accessible for a heterogeneous category of people, including even the most fragile. During a particular physical activity, data collected by the smart things can stimulate and nudge users to change their behaviors. The same data collection also permits smart things to elaborate personalized motivational strategies.

Lastly, the interoperability and scalability of smart objects promote computed civics (DiSalvo et al., 2016), as they are able to provide strategical data collections on citizenship health which can help governments and policymakers to take sustainable decisions and interventions to improve well-being and life conditions of the population and prevent negative impacts of social health.

Based on the above considerations, this paper presents a case study that focuses specifically on developing responsive and inclusive outdoor smart technologies that foster active well-being through data-driven strategies.

PLEINAIR: a case study for active well-being

The PLEINAIR project

The presented case study, named PLEINAIR, acronym for *Parchi Liberi ed Inclusivi In Network per l'Attività fisica Intergenerazionale e Ricreativa* (Free and Inclusive Parks in Networks for Recreational and Physical Intergenerational Activity), is an interdisciplinary research project financed by the POR FESR 2014-2020 program, regulated by the Emilia Romagna Region in Italy. The project aims at reframing the concept of green public space by developing an inclusive and inter-active outdoor park that discourages a sedentary lifestyle through an enabling environment that supports physical activity.

The system is composed of an IoT-based infrastructure (Internet of Medical Things) and a series of recreative and fitness outdoor furnishings, named OSOs (Outdoor Smart Objects), which foster conviviality, socialization and active lifestyles among different generations of citizens.

On one side, PLEINAIR improves the quality of citizenship's social life by designing an inclusive recreational environment that promotes relaxing experiences, incites social relationships, and collective playful activities among people of different ages, characteristics and skills. In that case, the traditional social barriers are broken down in favor of an intergenerational, equal and shared space in which seniors, adults, teenagers and children can interact to each other without any limitation.

On the other side, the project enhances the citizen's health condition by stimulating people of all ages to perform physical activity around the public space through direct interaction with smart objects. The OSOs can provide citizens with accessible, comfortable and personalized fitness or gaming experiences as they can recognize a specific registered user profile and dynamically adapt their morphological and functional characteristics to her/his performance, skills and personal preferences.

Citizen engagement is sustained and prolonged in a long-term period due to customized and profiled motivational strategies – based on gaming and social elements, such as leveling up throughout different challenges, winning prizes, playing or competing with other users, and so on – that provide the users with targeted hints and tips but also with new personal challenges or planned exercises according to their well-being, abilities and behavioral patterns.

General concept

One of the limits of IOT technology, as it has been used up to now, is to establish a one-to-one relationship between user and smart object and to limit the relationship between people to sharing data or interacting in specific digital spaces, inside the applications. So users tend to interact, in these limited spaces, only with users who have skills and abilities in the use of the app similar to theirs. Furthermore, all the time spent using an app, in this scenario, is subtracted from the potential relationship with people in physical space. The reason why this happens is to be found in the fact that the initiative of the smart-object proposal, for now, is for the most part of a private and commercial nature. IOT technology makes it possible to increase the bond between user and product, to build loyalty, and to increase the knowledge of the user's habits, preferences, and behaviors by the producer and supplier of objects and services in proportion to the time and attention the user devotes to the product and service. In this sense, from a commercial point of view, any unmonitorable user interaction outside the system is considered a loss of profit.

The objective of the PLEINAIR project is first of all to increase the user's awareness of the behaviors that can improve their well-being, promote an active life and mitigate the impact of aging on the quality of life, and in this sense, the current approach to the definition of smart-objects would seem sufficient, as it is focused on obtaining significant results for the individual. But a no less important objective of the project is also to foster interaction between users of different generations in the physical space of a public park through the proposal of activities that lead to sharing spaces, building relationships, and promoting communication: in this sense, the current approach to IOT is neither sufficient nor recommendable.

For this reason, great importance has been given to the physical and spatial components of the project, which prevails in terms of perceptibility compared to the digital ones. All the OSOs have been conceived as usable and desirable objects by every user of the park regardless of his age and physical condition, and the dynamics of interaction with the user require an extremely limited need of time spent on the app for mobile devices. On the contrary, they definitely favor direct and sensitive interactions, shareable with other users on the physical environment. The IOT paradigm was mostly used for the personalization of the experience on the characteristics of the users involved in the interactions so that their attention was focused on the experience itself and on the interactions. For this reason, the OSOs have the appearance of simple objects, not hi-tech, they do not involve the use of displays or other distracting elements. The users can evaluate their performance, and customize their preferences in a range of time other than that of the experience.

The OSOs characteristics

PLEINAIR adopted a human-centered methodology (Mincoletti et al., 2020), speculative design (Mincoletti et al., 2021) and a participatory co-design technique (Mincoletti et al., 2022) to conceive, design and develop the final prototypes. The project consists of an IoT-based system equipped with four different recreational and fitness outdoor smart products that promote active well-being for citizenship. A PLEINAIR application for mobile personal devices acts as the interface between the users and the OSOs, providing many challenging and playful games or fitness activities that deliver tailored experiences and personalized motivation strategies based on the physiological parameters or personal preferences of every user.

The final characteristics of the OSOs are:

- OSO-1: An integrated smart module made up of a green module (OSO-1.1), an interactive table (OSO-1.2), and a fitness bench (OSO-1.3). The green module uses a soil moisture sensor, temperature, humidity and solar light exposure to monitor plants. The latter can be monitored remotely with the PLEINAIR mobile application. A specific digital experience, named Care The Plant, enables users to engage with nature through botany learning activities. The interactive table runs agility and cognitive visual games while the fitness bench provides gymnastic activities. Both OSO-1.2 and OSO-1.3 are equipped with the same smart tiles of the OSO-4.
- OSO-2: a swivel chair equipped with a sunshade for guaranteeing moments of privacy and protection from atmospheric agents to different generations of users Fig. 1.
- OSO-3: A smart chair made up of a stand assist lift (based under the seat), and ergonomic armrests that can recognize seniors or citizens demanding assistance and enables them to sit up independently Fig. 2.
- OSO-4: An interactive floor made up of several smart tiles equipped with sensors and visual feedback for playing different games as well as playful and gymnastic activities.



Fig. 1
PLEINAIR project. Realization of the OSO-2. Credits: Michele Marchi.



Fig. 2
PLEINAIR project. Realiza-
tion of the OSO-3. Credits:
Michele Marchi.

The smart tiles are the core of the entire system because they can communicate with the app and run all the interactive activities. Each smart tile senses weight pressure, weight distribution, tap force, gait speed and execution time, and merges them to build and monitor different game experiences. For example, the OSO-1.2 can be used to play cognitive games such as tap lights. The OSO-1.3 can execute gymnastic activities such as squats, steps, long lunges or jumps. Lastly, the OSO-4 can run many complex games such as "The Floor Is Lava, Catch The Mole or the Obstacle course race". Data-merge unit records and processes different parameters to evaluate the final performance of each user while performing a specific activity: the time spent to finish the exercise, error rate, and reaction time spent to tap every tile. The dataset is the source to elaborate motivational strategies, propose new planned exercises or balance the level of difficulty based on users' performance.

Tests

In order to validate but also to improve the morphology, the interactions and the physical exercises hypothesized for the specific OSO, tests with real users were also carried out in the Museum of Rural Life in Bentivoglio (BO). These tests concerned morphological, functional and interaction aspects, as better explained in the description of the OSOs in the previous paragraph.

The tests lasted, on a non-continuous way, from 23 October to 17 December 2021. Test activities were organized over multiple days which saw the total presence of 114 users.

The purpose of these test days was to simulate real life days in a public park. Due to obstacles related to the safety of the area and the prototypes, an indoor experience was provided inside the museum of Villa Smeraldi. The space was equipped with a large wooden platform, which contained all the designed OSOs. A ramp with 4% degree of slope allowed comfortable and inclusive access to the site; a very large window allowed users to observe the surrounding park and identify with the nature.

The goal of the tests was to understand how users judged the prototypes with regard to some aspects. All the indicators described below, refer to the general and overall experience of the game and therefore include the assessment of the environmental context, the physical activity, and the morphology of the object Fig. 3. The assessed aspects are as follows:

- accessibility;
- usability;
- perceived utility;
- appreciation;
- functionality and safety;
- improvement measures.



Fig. 3
PLEINAIR project. Preparation of the demonstrator inside the Museo della Civiltà Contadina (Museum of Rural Life) in Bentivoglio (BO) with the presence of thean interactive floor (OSO4). Credits: Michele Marchi.

In addition to a critical reading of the non-verbal language (enthusiasm, curiosity, attention; these aspects have been specifically evaluated for people with cognitive disabilities or children)and the specific activity, all users were asked to fill out a specific unified questionnaire using standardized tools (eg. SUS). The performance expectations were measured on the basis of a 5 level Likert-type response scale (1 = disagree; 5 = completely agree). The questionnaire was made more accessible by associating a series of icons to the scale, in order to visually help users with cognitive issues to give the answers. The collected data aim to define the perceived utility,

usability and acceptability of the system by target users. The sessions provided for a free or guided use of the OSOs, according to the users' needs and their familiarity with the use of the device.

As outlined below, the tests saw the participation of diversified users Fig. 4:

- members of the *Bentivoglio nel cuore* association, whose purpose is to disseminate correct information on cardiovascular diseases. The volunteers were divided into small groups of users (3-4), to whom was submitted the prototype.
- Diversified users by age and characteristics (families, children, tourists, adolescents, seniors, ...) involved during the *Festa della Semina* (Sowing Festival), Open Day of the *Gusto di Autunno* (Autumn Taste).
- Expert users who attended a meeting during which PLEINAIR project was shown to stakeholders belonging to the public and private sectors.

The analyzed data of these first three groupings have not been developed in an analytical and scientific way but only at a quantitative level. Effectively, the tests were performed without the constant presence of a moderator. Our goal was to understand, for some types of users, what was the instinctive and emotional reaction using and experiencing PLEINAIR products.

Below are the types of users for which desirability, acceptability and usability tests were performed according to the aspects mentioned above.

- Typical and regular users of the Museum park who may be interested in the permanent installation of the prototype in space. Mainly people over 50 with good motor skills in the lower and upper limbs. The tests were performed on 10 people.
- Users of the Park with physical-cognitive issues. Three different groups of people with disabilities tested the prototypes accompanied by educators and specialized personnel. Tests were performed on 18 people; 10 had medium or mild cognitive impairment; 8 were people with physical disabilities (wheelchair or walker).
- Elderly users who regularly frequent the park.
- Adult users with physical/cognitive disabilities from Day Centers who do not know the park; they were accompanied by the referents in two occasions. 15 people with disabilities were involved and were helped as they were not completely autonomous in all phases of the test.
- Teen users. Two days of testing were dedicated to students of three high schools: the Serpieri Institute, the IPAA Ferrarini and the Belluzzi Fioravanti Institute of Bologna. Some of these classes had already been involved during the previous co-design workshops and therefore were able to observe the changes that have taken place. 51 teenagers were involved. For us it was important to involve a good number of people for two main reasons: the first one was because we still had not collected data regarding the experiential perception of this specific user; the second one, because we were also interested in observing the dynamics of involvement between different types of users, such as the elderly-adolescents or adolescents-children.



Fig. 4
PLEINAIR project. Preparation of the demonstrator inside the Museo della Civiltà Contadina (Museum of Rural Life) in Bentivoglio (BO) with the presence of the interactive floor (OSO4). Credits: Michele Marchi.

Results

As mentioned in the paragraph above, the results of the tests are processed thanks to 3 application and methodological tools:

- direct critical observation during the activity (having the role of active moderator or passive observer);
- multiple choice questionnaire with closed answers (appreciation);
- ideas, comments or suggestions clearly expressed in the questionnaire.

The questionnaire was structured into three subparagraphs:

- information regarding the usability of OSOs;
- information concerning the usability of the App;
- information relating to the perceived utility.

The data were collected using a Likert scale from 1 (strongly disagree) to 5 (strongly agree).

Information regarding the usability of OSOs:

- I was able to use all OSOs;
- the exercises are easy to do;
- I think I do not need the support of someone else to use OSOs (Device Interaction);
- I felt safe while using the park's OSOs;
- surfaces are stable;
- surfaces are regular;

Information concerning the usability of the App:

- the App communicates well with the OSOs;
- the texts are well written, I can understand immediately what I have to do;
- the app graphic is intuitive, I can immediately understand how to use the app in order to play and interact with the OSOs;

- icons are representative of what they refer to;
- I guess most people can learn how to use the system very quickly;
- information relating to perceived utility;
- I think I would like to go often to this Park if it is available;
- I feel more motivated to do physical exercise or go to the park;
- I am more aware of my state of health;
- I had fun;
- I like the activities proposed by the OSOs.

As better specified above, the questionnaire aimed at providing punctual and general answers regarding the aesthetic, functional and motor appreciation of the PLEINAIR OSOs. Users expressed a positive opinion (4 or 5 of the Likert scale) to all the questions with an average of 68%. On the other hand, only an average 3% expressed a rating of 1 or 2.

The quantitative and qualitative answers of the questionnaires confirm the empirical evaluation obtained thanks to the critical vision during the performance of the same activity. Trying and testing new playful and physical activities, or even just updated with innovative technology or interfaces, has intrigued all users, from children to the elderly.

One of the critical issues identified was related to strengthening the visual and luminous language together with the sound. Elderly or people with mild visual impairment are unable to distinguish colors or do not have the cognitive speed to observe them. In this case, having the possibility of being informed also through the sound and voice, can certainly facilitate some activities. The project implication is that the planned design is to implement the electrical system with the acoustic one, so only the person carrying out the activity can hear the information received avoiding to cause disturbance to other people who are carrying out other activities.

Even the activity Care The Plant was not very empathetic and immersive. However, this activity was specifically designed for the elderly and children with the idea of carrying out therapeutic workshops or awareness raising workshops on nature, even remotely and observe the evolution of nature over time. It was an activity conceived with outcomes in the medium-long term and not to be developed in punctual and sporadic episodes.

In conclusion, we are quite sure to confirm the pleasantness of the experience with respect to all the users involved.

Conclusions

Thanks to the PLEINAIR project and to the applied and experimental research carried out to achieve the above-mentioned results, it is possible to disseminate some evaluations and conclusions. This information can be useful both for a possible continuation of the research and facilitate a critical reading on the status of the topics mentioned.

Hereinafter, are some evaluations:

- Integrating the strategies of traditional games with technical and technological innovations has found good results with the ultimate aim of encouraging people to go to the park, improve their health and trigger socializing and challenging dynamics, suitable for all ages, abilities and needs.
- Data collection and elaboration can help to provide inclusive and customizable experience to all users at any stage of life by adapting the OSOs to their capabilities and habits.
- Data collection and elaboration can help to sustain active lifestyle by stimulating people through tailored motivational strategies based on their capabilities and health status.
- Nowadays, the chance of processing the collected health data, is leading people of different ages and abilities to access a more efficient and informed management of their health, thanks to the support of wearables, mobile Apps, smart environments and social networks.
- By validating some physical exercises, for example with the physician or physiotherapist, the person can perform an accurate and specific physical activity, aiming to improve their performance and/or their health status.
- The data collected from the recreational equipment can help Public Administrations to have a picture, as accurate as possible, of the health condition of their citizens and their public parks. This can help the better management of green spaces at the level of urban planning and regeneration of spaces.
- In order to manage the cultural and environmental transformations of a given context, the active involvement of the citizens and the organizations who live and frequent a specific area is a good approach. Only in this way we can be sure that the project will satisfy the real needs of people. Involving people in a participatory design, exponentially increases the perceived utility and triggers virtuous dynamics regarding the maintenance and the positive and proactive management of the area.

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This contribution was redacted by the authors in this order:

Giuseppe Mincoledi is responsible of project funding acquisition, research direction, and concept design; he contributed to editing and reviewing the paper and wrote the section about general concept and part of the abstract.

Gian Andrea Giacobone contributed to editing and reviewing the paper structure and drew up the section Introduction; active well-being; to cure to care; IoT, data, and new smart citizens; the PLEINAIR project; the OSOs characteristics.

Michele Marchi contributed to editing and reviewing the paper structure and drew up the section Tests, Results, Conclusions

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Counterpoint. Are We Sure That All These Data Are Good for Us?

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Abstract

This paper focuses the relationship between data technologies, meaning the set of tools and devices of different nature, and the transformation of reality into data, from their collection to their use. We confine our reflection to the use of data related to the body and the ability to establish its state of health or illness. A critical stance is adopted, reflecting on the impact that data have - and may have - on biological, legal, cultural, and social bodies. It aims to highlight problems and potential side effects, emphasising the need to create 'connections' between the individual device and the large technical system; between the personal data and the system of collected data; between the present and the future scenarios towards which it is desirable to orient design. The paper aims to open up questions on the relationship between us and the knowledge of our body, beyond the promises of idyllic worlds presented by data technologies. And what role can Design play in this context?

Keywords

Datology

Mediation technologies

Medical deskilling

Senses and sensors

Reflective design

The reality and the data: “The exams are perfect. The patient is dead”

Datology, namely the tendency to translate all the complexity of reality into simple, quantifiable, and relatable elements, has recently entered the medical world (Richterich, 2018). A process of distancing the physician from the body and its concreteness to rely on representations, is accomplished by translating signs and signals of the body into data or codes of a different nature. Acquiring the competencies required to read these representations is an integral and not secondary part of the long learning process of diagnostic practice.

The datology pervasiveness is bringing its effects to the medical world to the extent that the data is taken as a substitute for reality, which can even sometimes lead the physician to avoid concretely knowing the patient. Translating body signs and signals into usable data fully affects the patient who, without any training, runs the risk of misunderstanding their meaning, with outcomes that may even be fatal. The ease of access to data sometimes drives patients to compulsive forms of data collection and induces self-diagnosis depriving the physician's role and competence.

This paper adopts an argued stance against the positivist attitude through which we usually consider technology, the supposed necessity of development, and the goodness of its objectives. These derive from social needs - whether real or presumed - embedded in the nature and logic of technology development or incorporated into technology through designers' reasoning.

The intelligence of the senses

The human body allows itself to be read by anyone who knows how to question it, through signs and signals capable of expressing a state of health, discomfort or even illness. Our experience of the body is a lifelong apprenticeship. Sensoriality constitutes a crucial tool of human experience: a diffuse brain (Craig, 2010) that, through the acquisition and processing of stimuli, keeps us constantly in touch with the world and our biological and psychological selves (Payne et al., 2015). The introduction of technologies that enhance the feeling, mediating the direct relationship between the sensory apparatus and the body, may represent a step in a process that might even lead us to deprive the senses of the processes of understanding our bodies (De Preester, 2011). In homecare, the thermometer is perceived as an object of scientific precision; it emancipates the patient and the act of measuring temperature from the physician's intervention. Due to its apparent simplicity of use, it represents the first taste of the process of transferring medical practices to the patient. Even for the thermometer, the importance of experience and the ability to contextualise data is undoubtedly essential for creating understandable meaning for both simple and complex pathologies. Relying on the instrument and its precision can lead to a loss of self-awareness and progressive distrust of sensory abilities. According to popular wisdom, a process that can result in the shrinking and reduction of our sensory abilities: *use or lose it*.

Another risk associated with indiscriminate access to health data is linked to the relationship between the subject's cultural background and the data's interpretation ability. In several studies, schooling has been correlated with the mortality index because a higher education level correlates with greater awareness and ability to interpret data from the body (Zimmerman et al., 2015). Data availability, even from various medical reports, together with the ranges of values separating normality from what deviates from it, is also fuelling the phenomenon of the *Do-It-Yourself Patient* (Lupton, 2013). Processes ranging from self-diagnosis to therapeutic self-prescription (Ryan & Wilson, 2008), find precisely in the wide availability of data and the apparent accessibility of their meaning, a trigger point for a perverse process that finds in the network the ideal place for self-confirmation. In these cases, we can define it as *cyberchondria*: due to anxiety, people obsessively seek information on their health status on the Internet. Since every discomfort is a business, websites appear providing diagnoses and suggestions for self-care (Ryan & Wilson, 2008).

Clinical semiotics versus statistics?

Rubor, calor, dolor: from Hippocrates to modern medicine, these are the quintessence of medical practice, linked to the clinical ability to perceive changes in the body. Many instruments and mediating technologies have been incorporated into the interaction between physician and patient. Among these, the most iconic is the stethoscope: it marks the transition from clinical practice relying entirely on the physician to clinical practice in which diagnosis depends on a medium. The physician becomes a *virtuoso listener* (Dankl & Akoglu, 2021), capable of hearing sounds that do not live independently of the body and without translation by the instrument. One must come to the following generation of diagnostic instruments - ultrasounds, X-rays, etc. - to have the division of the body from data about the body. Data is translated according to visual or numerical codes, which the physician learns to read through a specific education. We witness a double transition: diagnosis can occur without the need to touch, auscultate, or smell the body. It can take place through actions occurring away from the patient. Dominated by the machine and its technicalities, the diagnosis moves out of hand. New professional figures - the technician, the data analyst - can replace the physician and a clinical culture refined from the patient and their peculiarities.

These technologies trigger a deskilling process of the physician (Cabitza, 2021) when an overdependence on the tool becomes apparent, even in the semeiotic reading of diagnostic repertoires. As with everyday tools, diagnostic instruments implicitly affect the way of thinking and operating of people using them (Tapscott, 2009): phenomena of dependence on the object and delegation of competencies can emerge from which people become progressively dispossessed (Dusi et al., 2002). Then, it is not guaranteed that the physician will be able to reclaim techniques and procedures given to the machine. The distancing from the patient's body, and the dependence on both the instrument and the data may reduce the physician's confidence in decision-making, and the patient's trust in the physician. Moreover, they can increase the stereotypical reading

of the patient translated to mere data and produce more significant levels of diagnosis and treatment standardisation (Cabitza et al., 2017). In the absence of solid medical experience, the deviation of data from a predefined range of normality can lead to interpreting what is not a disease. For this reason, the physicians' educational pathway foresees the apprenticeship: a crucial moment to train the perceptive abilities and to mitigate the possible risk of considering the teacher-discourse and the textbook learning as knowledge without uncertainty. One of the skills distinguishing the expert physician is being able to read the patient's medical history data at a glance. The single data is connected to the others and evaluated; its variations linked to the complex context of healthcare. In other words, for the physician, "the data is not just a data but is a story with a name and a surname" (Oral source, Dr. Bestetti, Sacco Hospital).

So near, so far: sensor technology

Above all, we dwell on those mechanical, electronic, or chemical devices that, due to their ability to detect different parameters, bear the name of sensors. Inserted in portable objects, in functional clothing, in biometric tattoos, in implantable devices or, thanks to nanotechnologies, ingestible, sensors can constantly monitor and record –so they promise– a person's positions and movements, body values, interactions with people and objects, etc. Their potential lies in tracking data and transmitting them to the person and to health centres, to make remote control and/or intervention possible. Sensors represent a link between the hospital and the home, inducing transformations that affect the socio-technical systems of care.

In addition, medium- to long-term research and development pushes on the integration of the Internet of Things, Artificial Intelligence, and Industry 4.0 for medical service platforms using blockchain or to feed ready-to-use body banks based on patient profiling (Crabu, 2016), or to build digital twins (Barricelli et al., 2019), a sort of avatar at the genetic micro-scale (Longo, 2003), a data bank on ourselves, our processes, our behaviours, current and future pathologies (Haya et al., 2021). The narratives of this transformation promise us existential forms of immersive telemedicine, mobile and virtual surgery, that can reach us anywhere (Pozzi, 2019). At the same time, the ongoing processes of digitising hospital services and reorganising territorial and domestic care are struggling (Luisi & Hämel, 2021).

There is a lack of new professional figures, capable of managing the transition with skills concerning the patient and the technologies. There is a lack of transition infrastructure between home and hospital. There is a lack of a primary culture about the body, illness and care, and digital technologies, which would guarantee a non-harmful autonomy of the remote patient.

Technological infrastructures and social bodies

Since McLuhan (1967), a broad reflection has flourished on the relationship between the nature of the medium and the content it conveys; on how the changing nature of the medium profoundly transforms cognitive methods and styles, mental structures, conceptual systems, and the values we attribute to the experience of knowing. Some implications that data technologies may produce in the future can already be glimpsed and felt both at the scale of observation of the individual medium and its applications, and at the scale of the complex *socio-technical infrastructures* present in the world of healthcare, which we read here in terms of the infrastructures of medicalisation (Toffler, 1970): places and non-places of new practices, new ethics, new policies, new cultures, new aesthetics that, by extension, organisation, the complexity of norms, procedures and for the multiple interactions and interdependencies between socio-institutional, technological, political, economic dynamics, overstep the problematic scale of the relationship between subject and techniques of care to question the person in being part of a social body.

The small observation scale may hide or mitigate the risk associated with information about our health; we have little awareness of such risk. Making this massive amount of information available to medical studies and research centers enables the development of more targeted, personalised treatments, more advanced diagnostic tools, and more effective epidemiological analyses (Crabu, 2016). The same data, sometimes collected without our explicit approval (Price & Cohen, 2019), make accurate profiling of the user-patient possible, placing in the hands of companies, political associations, insurance companies, and employers. They become potent tools for orienting production strategies and policy proposals and defining potentially discriminatory criteria since they are based on knowledge of individual health status (Pozzi, 2019).

Technology does not simply introduce peculiar ways of production and consumption. It supports and is supported by new values; it feeds and is fed by new lifestyles (Nacci, 2004). The intertwining of technology and society opens up problematic insights into the social role of technology and its developments. Technology diversifies, and in diversifying, it creates inequalities. It makes people autonomous but introduces forms of control. It opens up new scenarios and potentialities and, conversely, harnesses through the complex organisational processes necessary for its deployment. It enables, but the knowledge and the skills required, and the specialised jargon it creates, define oligarchies of followers, generating new forms of ignorance and illiteracy.

In health practices, these dichotomies reveal all their criticality. Technology cures but, at the same time, generates side effects. It provides specialised answers, yet it normalises problems standardising the patient and the disease. It is accessible only when it overcomes knowledge and economic barriers. Healthcare requires the sharing of frame values, such as personalisation, democracy, and accessibility to systems of diagnosis (Habermas, 1978). Most of the technologies of care, perceived as future, are already here; this leads us to consider the issues of technological expectations, even conflicting interests around its developments, and policies supporting potential desirable trajectories with a different awareness.

Design as a socio-technical practice

Besides the undoubted progress that data technologies allow, this paper aimed to glimpse some criticalities probably underestimated. At the individual scale, we can highlight some issues such as: the human patient/doctor relationship converted into a patient/device relationship; the reduction of health status to quantitative data; the management of sensitive data; the reading and understanding of corporeity; of the proximity/familiarity of the diagnostic experience; of the extreme qualitative complexity of corporeity reduced to a set of sparse quantitative parameters. At the macro-scale, it seems to take place a process of reshaping the healthcare places without an overall idea of reconnecting the subject and the system. In this groove between micro- and macro-scale, technology moves from a present that builds systems and infrastructures, even without a systemic project, towards a mortgaged future, as it is deprived of ordinary acts of prefiguration and verification.

Several factors contribute to the lack of connections between different levels of technology, to the underestimation of problematic elements, in the realm of complexity. We linger on some of these without claiming to be exhaustive, outlining some elements for reflection, especially for the role that Design can play in this domain.

The mythological attitude towards technology

Narratives about technology are obsessed with the future, understood as the space in which everything is resolved, from shortcomings to the limits of technology (Ballatore & Natale, 2020) to controversies about the role of technology (Hirschheim & Lacity, 2000). This narrative makes the project face the risk of dismissing as irrelevant the critical links - ethical, philosophical, legal, cognitive (Nacci, 2004) and design-related - between: the real body and the data-body; between the individual body and the social body; between the promise of a cure that is always available because manageable at a distance and the disillusionment of a cure that is unavailable precisely because it remains at a distance from the concreteness of bodies. Faced with these narratives, in which technology becomes an event and is treated with the characters of spectacularity (Baule, 2017, p. 96), Design needs a change of direction. To take seriously the difficulty in forecasting the potential of technology into the future and still more in guiding it through the project (Manzini, 2004); not to overlook the stumbling blocks and testing grounds of experimentation and research; to examine the failures and difficulties in involving users in trials (Lupton, 2013). Here is an initial summary, even far from the rhetoric of *everything solved*, that may constitute an initial and essential welding point between the present and the future.

Technological paradigms and focusing devices.

Scientific paradigms and mechanisms of censorship and self-confirmation have the power to orient research questions, the dissemination and debate of results, and the acceptability of concepts,

values, and principles of the research tools themselves. Research interests can be oriented by public funding and industrial investment policies, the technological expectations constructed by scientific communities and industry, and market demand that incentivises and confirms the promising technology bias (Sridharan & Greenlad, 2009). Sometimes the researchers adopt a confirmatory logic concerning the goals and values proposed by the community of reference, constructing *focusing devices* (Rosenberg, 1969). This approach contains the germ of positivism towards technology. It contributes to discouraging pioneering and experimental projects, distortion of research data, and making researchers less objective about the critical issues that need to be addressed in implementing new technology.

Bodies as machines and network technologies

In healthcare, the acritical use of data about the body presents two major risks. The first concerns reducing the body to a machine, to its techno-functional dimension. The body becomes readable through the eyes of standardisation, seriality, invariance: in a binary logic, to states of health or disease. Moreover, in the cultures of the body, the clinical case is always a *unicum* that is difficult to relate to standard data, pathologies, protocols, and treatments.

The second concerns our unawareness of being enveloped by systemic technological infrastructures that connect everything. This makes us less capable of grasping the connections between individuals and society, between small and big data, between the meaning that data takes on at the individual and contextual scale and the limits of its usability when transferred to other individuals and other contexts of use. Such meaningful connections between objects, information, and people, dissolve. For example, a sensor so tightly coupled to the body does not even hint at the existence of a complex technological reality. It is just a small and simple device to the user, but the designer cannot forget that it is part of and only works when considered within the large technical system. Besides being makers of individual technical objects and facilitators of human-object interactions, designers and engineers assume the responsibility of being creators of large socio-technical apparatuses.

Research and design as socio-technical experiments.

In innovation processes, there is a real reversal of the paradigm, an “overtaking of action over knowledge” where “the ability to act greatly exceeds the ability to foresee, and technology is important for what it allows you to do, not to understand” (Pizzocaro, 2017, p. 13). This passage is important for focusing the nature of Design interventions, which instead presupposes a true statutory transformation. In this scenario, there is a transformation in the methods and places of research and design. They leave the tabernacles of the laboratories and happen (Latour, 2004), in the form of a widespread and collective experiment, in direct contact with society, investing different scales of reality, involving institutions, public and private organisations,

citizens, patients, etc. This means constructing fragments of reality, already in experimental practice, through the form of the active involvement of the user system. These are large socio-technical experiments that go beyond the scale of the here and now and move from things (*states of affairs*) to cases (*matters of fact*) (Latour, 2004, p. 147). In Design character as an inclusive and collaborative social practice, we detect a real ethical turn. Design becomes a creator of open projects, shared in values and responsibilities related to the risks implicit in every decision with uncertain outcomes, in becoming, and for this reason, unpredictable (Manzini, 2004).

Finally, research and design on data technologies, while engaging on the issues of the breadth of dissemination, ease of understanding, and democracy of access, might forget that data is not knowledge. Involving in the decision-making system the plurality of stakeholders in the design process of the technical systems of data technologies, implies considering the design processes as places of social learning, in which each person is informed and can understand and decide autonomously (Manzini, 2004). The first step lies in treasuring past knowledge and experience; in the awareness that there are certain recurring traits in the evolutions of a technical system. It lies in making available the knowledge typical of experts to co-design the future, knowing its starting point is already today.

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The Augmented Body: Technological Contamination in the Fashion-Tech Paradigm

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Abstract

The paper aims to address how dresses and garments in the fashion-tech are beginning to acquire their own shape and meanings: the technological, electronic dress with digital, bionic, or robotic components can act and move independently from the body that wears it, sometimes even modeling, modifying or altering its shape.

According to these perspectives, techno-fashion products become alive because they react autonomously to external or internal inputs, they become able to mediate the relationship between the human body and the world around it in a new material dimension that lives in a fluid environment with blurred boundaries between the physical, digital, and biological spheres. This highlights the pivotal role of new technologies for the study of fashion, as by empowering the human body they can influence human relationships with themselves, others, and the environment. These transformations involving the collision between technology and fashion could have long-term implications that affect the shape and meaning of our clothes as well as our bodies.

Keywords

Augmented body
Wearable technologies
Fashion-tech

The de-structured body

The transformative energy of the contemporary is characterized by changes and challenges in which issues such as volatility, uncertainty, complexity, and ambiguity (VUCA) become central in addressing the demands of the present. Transformation proposes layered and intertwined complexities, laying in twin transitional phenomena - digital and sustainable- that are found to affect different phases of human production dynamics and thus consumption, production, communication, organization, and value generation. Disruptive changes also affect the very idea of dress concerning the body that wears it, making fashion an ideal testing ground for emerging paradigms (Kawamura, 2018).

As Bradley Quinn (2002, p.360) has already written, “technology has always been the essence of fashion”. This assumes even greater importance in the emerging paradigms in which the digital brings about a radical transformation of the systems of use and production of goods, services and contents. In fact, while the widespread presence of digital tools offers fashion new ways of producing and manifesting itself, as demonstrated by the recent experiences of 3D fashion and digital couture, it also intervenes in the same symbolic and identity functions of clothes and garments. An example of this is the work of Anouk Wipprecht, who uses animatronic mechanical limbs that react to external stimuli defending the personal space of the wearer, as well as Iris Van Herpen’s, in which the digital and the material, the human and the non-human intertwine. This type of interweaving refers to posthumanism “that postulates a dynamic notion of life in which human bodies are inextricably entangled with the non-human” (Smelik, 2020, p.2).

In this fast-paced and connected contemporaneity, dresses as spaces to live, disguise, cover, and protect oneself, come to take on their own meaning, often unrelated to the body that wears them: while maintaining a central role in the processes of culturalization of the body -that is, what makes human physicality to all intents and purposes a cultural object (Bovone & Ruggerone, 2006)- clothing is enriched by wearable technology, bringing out a new agency for inanimate things in a tangible matter (Smelik, 2018).

Thus, by conceiving a research framework for the advanced design culture in the Transformation Era, the contribution discusses some experimentations in fashion design aimed at pushing Transformation through Transition in both physical and digital dimensions of reality (Pozniak, 2019; Vaccari & Vanni, 2020), which, in turn, affect traditional fashion design paradigms. Hence, the paper will highlight how these values can soon affect fashion’s production, distribution, and consumption models, as well as reshape the modes of representation by and through it. In these new dimensions, fashion can address new narratives by investigating the role of non-human factors through more-than-human design approaches. The aim is to contribute to a broader debate that helps to develop the next design direction for fashion, aiming at conceiving products able to trigger a new culture and consciousness of fashion by interpreting contemporary transformations.

The behavioral modes and dressing of Generation Z belong to an often decontextualized dress that subverts the canons of use: thus, the parts of the dress system take on a different meaning than what had been established over time, rendering clothes devoid of stable relations to the environment, occasion, gender, and person. While it is thus well known that wearing clothes represents not only the fulfillment of a physiological necessity, the contribution aims to highlight that the functions of dressing remain unchanged in their material aspect but are transformed and amplified with digital components in their performance, symbolic and emotional aspects.

In this scenario, the potential of embedding technologies merges with designing for embodiment, bringing the field of wearable computing more closely to the field of fashion. As wearable technologies are becoming more than just mediators of perception (Seymour & Beloff, 2008), fashion tech emerges as a field of study through design. The paper, therefore, aims to investigate how new forms of wearable technologies blur the boundaries between technologies and the body, creating an augmented body (Wissinger, 2017) and fostering new relationships between bodies, materiality, humans, and technologies (Toussaint, 2018).

From wearable technologies to techno fashion

The massive development of technologies has led to a radical transformation of information fruition and production systems due to the introduction of devices that enable interactive and multidirectional communication. The function of the body thus goes seamlessly into the scenario of a technological-cultural *mediamorphosis* in which the progressive evolution of processors and digital components intervenes on the wearability of digital technologies by making the device itself an integral part of the garment.

Three different functions are generally recognized in dress: protection, modesty, and exhibitionism (Morris, 1982). The function of protecting is connected to the comfort, to the psycho-physical well-being of the person. To protect ourselves and our bodies, modesty takes over: we usually cover ourselves to block some physical signals; the more society shows anti-sexual needs, the more the dress hides the body, the more society does not exclude itself from manifesting its sexual impulses, the more the body is discovered. The last function of the dress is the exhibitionistic one (Roach-Higgins & Eicher, 1992) which fulfills the arduous task of giving the subject insertion within a specific social group, related to the dress one wears.

A large number of enabling technologies (Čolaković & Hadžialić, 2018; Silva et al., 2018) have become widespread, easier to use, non-invasive, mature, cost-effective, and above all, potentially combinable with each other. This has made digital devices smaller and smaller in size, but better performing: as computer scientist Mark Weiser (1991) predicted, technology has now receded into the background of our lives, becoming so sophisticated that it is embedded in clothes, pillboxes, toothbrushes, and smartphones (Schüll, 2016). Transmission technologies are progressively abandoning their old role as simple devices for storing and transmitting data, to shape themselves in relation to users' needs (D'Andrea, 2005).

In fact, until a few years ago, research on wearable technologies had mainly focused on their application for health and fitness (Choi & Kim, 2016), or electronic textiles (Berzowska, 2005) by proposing devices to support self-tracking with the goal of monitoring, analyzing, and sharing personal data on well-being and lifestyle (Sanders, 2017).

In the Internet of Everything paradigm (DeNardis, 2020), wearable technologies become objects and tools integrated into everyday products, blurring the boundaries between the physical and digital worlds. Augmenting the physical through the digital, technologies can now be worn as integrated components in textiles, fibers, clothing, and accessories. Robotics, mechanics, and mechatronics, as well as bio and nanotechnology, enter the garment allowing the introduction of foreign elements and new ways of relating to traditional components of a wearable product. Thus emerges a new body, re-dressed, technological and electronic, intelligent, flexible, resilient, communicating and working, extended to internal and external prostheses, enriched by sensors, shells that repair it, extend it. Thus, the wearable landscape enriches body-mounted technologies (Dunne, 2004) with smart and electronic textiles in which the digital can be woven, knitted, embroidered, sewn, and printed (Berzowska, 2005), then integrated into materials that allow fashion to enter the field of wearable technologies, embracing both high-tech functionality and fashionable design (Wright & Keith, 2014). With the rise of fashion tech, wearable technologies address a new space of experimentation between the body, the environment, and materials leading to new kinds of hybridization that go beyond the body, but also beyond the traditional concept of dress. By enabling new forms of relationship with the external environment and shifting the boundaries of the body, devices accelerate and promote interactions, redefining the identity of dress.

In the transformative context, the fashion-technology connection is manifested through moving fibers, polymers, sensors, invisible or photoluminescent that act on the garment by making it an intelligent envelope adaptable to changing conditions. The garment thus becomes a surface, an interface, in which the channels of dialogue with the surrounding environment and the body wearing it are increasingly sophisticated and performant.

The augmented body

The arguments expressed so far place us in front of a transformative scenario of the clothing system, in which what suggests interesting areas of experimentation is the body-wearable-technologies relationship itself. Thus, a research space in Fashion-Tech is being consolidated that brings out new areas of experimentation between the input and output of wearable technologies that intervene on the human body by extending and expanding it through wearable products that are increasingly autonomous in terms of functionality and formal aspects, but increasingly connected with the external world.

In this section, therefore, three case studies, the result of experimentation carried out at the REI laboratory of the University of Florence, Italy, will be exposed and discussed. The proposed experimentation is not limited to the implementation of technologies on

the garment (e.g., through the use of robotic systems, biomaterials produced through 3D printers combined with traditional materials); but aims at a vision of augmented body and interpreter of futures, in which mechatronics, combined with robotics, enters the wearable product, configuring a product form not directly related to the body shapes with the ability to mutate autonomously and defining new performances in relation to the different morphology.

The three presented are the most significant cases extrapolated from a production of 50 concepts that highlight the variety with respect to the ways of interpreting the augmented body. Full-size prototypes of these concepts were produced.

XXXCo,Ltd

This dress is part of a collection of clothing and accessories that alter the modes of covering oneself and interpret social transformations in non-contact collective interactions. The concept emphasizes the importance of lower limbs for walking long distances, running, and being able to observe, and the non-necessity of upper limbs replaced with a series of multifunctional and multisensory elements with the ability to move independently; with the covered mouth, the importance of sight and hear is emphasized. This is a concept for a different social security, a population focused on information accumulation and not practice, reducing their practical experience and creating new visual and auditory knowledge.

Materials: phosphorescent composite fabrics, graphene fabrics, flexible screens, polymer optical fiber, copper wire, carbon powder. Self-heating Fig. 1.



Myrtillocactus

The concept involves a transformable dress, capable of taking on different configurations depending on inputs from the indoor and outdoor environment. The dress is equipped with an electronic control that can emit light in a spectrum of 256 colors. It thus takes on various configurations: opaque, transparent, luminous, and the upholstered part is of variable density. The dress concept expresses, breathes, covers, or uncovers the body by altering its function of protection, modesty and exhibitionism (Morris, 1982).

Materials: elastic and heat-regulating fiber Fig. 2.

Fig. 1

XXXCo a project by Cai He, Ji Chenxi, Zhou Anqi, Zhou Haoze. The XXXCo,Ltd project features a dress composed of a series of modular, flexible doughnuts that can move on their own, tighten, inflate and come to life on the body. The operation, enabled by a special combination of silk and Nitinol threads (a nickel titanium alloy), is simple: if the thread heats up, the doughnut changes shape by shrinking; as soon as it cools, the rigidity of the thread allows it to inflate. The lining of the fabric is made entirely of graphene, a material consisting of an atom-thick layer of carbon, as strong as a diamond and as flexible as plastic, which gives the garment the ability to absorb, transmit and dissipate heat; it counteracts the reproduction of bacteria and gives the fabric itself high durability. Model prototype made with Clo3d software.



Fig. 2, 3, 4
 Myrtilocactus, a project by Elena Guidi. The dress is designed using MaTech¹ technology, a photoluminescent polyester yarn, where power can be supplied by a standard transformer, a commercial 9V battery, or small rechargeable batteries. The fabric lights up through optical fibers, and thanks to a microchip the light emitted can be varied in a spectrum of 256 colors at the push of a button, without the need to change garments. In this case, the clothing becomes recognizable in a dark environment by promoting a human experience of recognition and defense in hostile environments. The model image was made with Clo 3d software. In image 2b we can see the prototype made on canvas.

¹
matech.it/materiali/fila-to-luminoso-nella-notte/

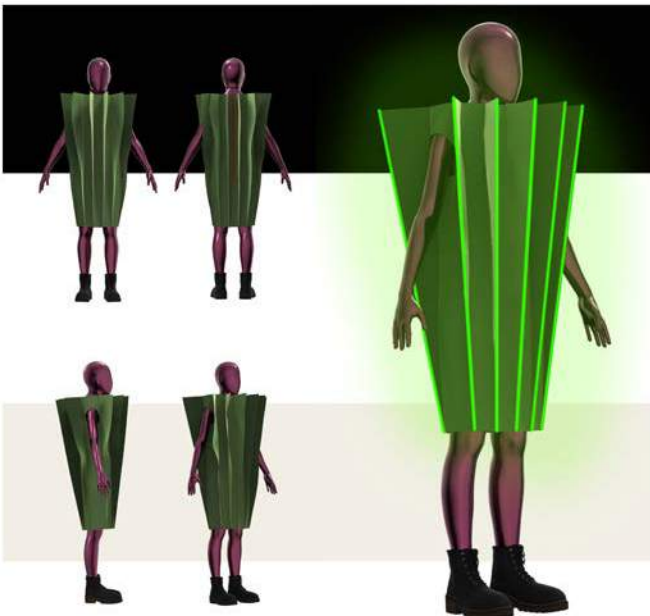


Anxiety

Those are concepts extracted from a collection dedicated to a fluid society in which the concept of gender and occasion no longer exists. Dresses for everyone in which the form can be determined by a mechanical system or by the movement of the body. These clothes interpret the emotional state of the wearer that is made manifest through luminous bodies, the transformations of clothes from soft to hard as armor, and the need for more and more protection from others and the external environment.



Fig. 5, 6
Pumpkin_Axiety e
Roll_Axiety a project
by Clarissa Salvicchi,
Roberta Baroni, Rebecca
Benelli, Matilde Gelosia.
In the Pumpkin_anxiety
gown, the supporting
structure is obtained
through the whale splint
and is derived from baleen
(foils found in the mouths
of whales). Each baleen is
composed of a substance
made of keratin that
gives it elasticity but also
rigidity and lightness. The
skeleton is then covered
with fabric, creating a
contrast between rigid
and soft, fluid and static.
Model prototype made
with Clo3d software.



The Fashion-Tech paradigm explored in these concepts proposes a framework in which technologies act and distribute the result of action in the surrounding environment autonomously, redefining the identity of bodies and wearables themselves. The result is an augmented body (Wissinger, 2017) that interprets the functional, decorative, and symbolic transformation proper to the acceleration taking place, in which technology is not only added, but conjugated to other technological, mechanical, or bio-nanotechnological systems capable of providing new physical and intellectual capabilities, going on to augment human ones through formally and performance autonomous wearables (Quinn, 2013).

Thus, clothes as a representation of an *equipped* body capable of transforming the quality of a person's life, bodies wearing clothes independent in form and function that give it the ability to choose the level and mode of performance.

Conclusions: post-human fashion

With a series of case studies of fashion experimentations through the integration of sensors, solar cells, responsive materials, and numerous other technologies into fabrics and clothing the paper addresses how dresses and garments in the fashion-tech are beginning to acquire their own shape and meanings: the technological, electronic dress with digital, bionic or robotic components is in fact able to act and move independently from the body that wears it (Toussaint 2018), sometimes even modeling, modifying or altering its shape (Quinn, 2013).

According to these perspectives, techno-fashion products become alive because they react autonomously to external or internal inputs, they become able to mediate the relationship between the human body and the world around it in a new material dimension that lives in a fluid environment with blurred boundaries between the physical, digital, and biological spheres (Schwab, 2017). This highlights the pivotal role of new technologies for the study of fashion, as by empowering the human body they can influence human relationships with themselves, others, and the environment. These transformations involving the merging of technology and fashion could have long-term implications that affect the shape and meaning of our clothes, "how we use clothing, what we expect of our garments and how we relate to fashion" (Brunstein, 2011, p.89).

The concepts presented are aimed at future markets generating advanced products to respond to new lifestyles but with the desire to experience sensory emotions that have their roots in the genius loci of our country. The concepts provide an experimentation on advanced wearable products in which technological innovation is combined with the innovation of all processes (formal, productive, performative). They reflect the need to intervene in a context that is so hyper-volatilized that it generates a design without a market (Celaschi, 2014): this implies that the same market should be designed, giving the designer a strategic role of aggregation around the autonomous observation of needs that have not yet been "filtered by the market nor by entrepreneurs that [usually] commission their resolution and transformation in goods or services" (Celaschi, 2014).

The research framework provides fashion design with new coordinates – identified as futuring through fashion design –, which have been experimented and tested through design. At a first glance, the framework relies on a radical shift in focus compared to the approaches traditionally related to them. In fact, it seems that fashion design practice is undergoing a sort of relational turning point by not assuming the centrality of the human in the design processes but focusing on the complexity that surrounds human beings and things (Smelik, 2021). A plurality of interdependent relationships emerges, resulting in tangled lines influencing each other mutually. In this sense, the very concept of *humanity* as we know it falters, with its profile appearing far more blurred than expected.

Reference is made to what Laura Forlano (2017, p.17) discusses as the emergence of “the hybrid figure of the posthuman – and related concepts, such as the non-human, the multispecies, the more-than-human, the transhuman and the decentering of the human – [which] greatly expands our understandings of the multiple agencies, dependencies, entanglements, and relations that make up our world”. The blurring of the human concept actually reflects a much wider extension, which embraces the entire perception of reality, both in its physical and digital component. Hence, the paper will explore these two dimensions considering, however, that they cross, overlap, and influence each other seamlessly.

This encouraged a series of experimentations which frame fashion design as the activity to conceive and develop wearable products tout court (Hrga, 2019), taking advantage of the latest technological advancements: in this sense new fashion products are not only sewn, but also 3D printed, assembled, welded (Bolton, 2016; Smelik, 2018). The projects presented combine robotics and nano-electronics, making fashion an experience that transcends mere appearances through products that augment the human body. In fact, the resulting garments gain the ability to facilitate and augment the interactions we have with ourselves and our surroundings, suggesting the challenging contribution of fashion in designing more-than-human proximity. Other than handheld devices, such experiences reshape the individual dimension and its spaces of expression through fashion, triggering new ways to interact with the world around us.

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Responsible Tech Innovation Through Design: A Participative, Reflective, and Systemic Approach

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Abstract

Technological progress has offered humanity many opportunities, though innovators need to gain knowledge in anticipating the impacts of their creations and dedicate themselves to more caring strategies, as many times technological advancements cause harm to the environment and people. In addition, organizations tend to respond to business externalities reactively, which has proven unsustainable. Understanding and identifying biases and expanding learning during the technological innovation process are essential to prevent unintended consequences. The future of responsible technology relies on achieving a more holistic view and enabling more systemic, sustainable, and responsible strategies. This study presents the formation of a substantive theory that explores the phenomena and development needs for designers successfully support responsibility in the technological innovation process. It reviews and compares designerly strategy models, methods, and frameworks. More concretely, it presents the process for defining a theoretical and methodological approach for a responsible, participatory, reflective, and systemic design.

Keywords

Responsible innovation
Co-creation
Innovation design
Sustainability design
Participatory design

Introduction

Technology innovation has supported humanity in reaching Mars. However, when tech innovators intend to create solutions for society's future (Bethune, 2022), they must still take responsibility and commit to measuring technology-enabled solutions' impact on people of all colors and cultures and the planet's diversity and harmony.

There have been adverse effects of technological advancement, many well-recognized and others still topic sensitive and challenging to debate (Costanza-Chock, 2020). For example, Technology has been criticized for perpetuating societal injustice and harmful biases (Friedman et al., 2017). Colonial legacies about the dominating North's political, material, and technological superiority (Parashar & Schulz, 2021) have also incepted prejudice and hate that remains.

On the other hand, human curiosity and willingness to build a better, just, and fair society are maturing our understanding of human rights, regulations, and environmental and biodiversity comprehension. In 2021 and 2022, the primary author collected extensive literature on Responsible and Sustainable Innovation and Design from social media.

The content reveals increased demand for more responsible and sustainable solutions and outcomes. Design, Business, and Technology, academics, and practitioners share, research, and seek processes, practices, methods, principles, and examples of suitable applications and tools that can fulfill these needs.

By using a grounded theory approach to this contemporary sample, this study aims to present the initial formation of a substantive theory on exploring the phenomena of Design practice in creating and developing sustainable and responsible technological outcomes. It proposes practical development needs that define principles for designers to successfully support innovators to take responsibility for technological solutions and operations. More concretely, this paper presents the process of defining a theoretical and methodological approach for a responsible, participatory, reflective, and systemic design.

Research Approach

The study relies on a grounded theory approach (Charmaz, 2014) consisting of various iterations until the desired outcome is achieved. As a preliminary phase of the theory construction, in 2021 and 2022, a documents analysis was made of a total of 95 professional and academic articles and case studies shared on LinkedIn, Twitter, and by Business and Design communities on Slack, such as Service Design Network, Design Justice, IxDA, All Tech is Human, Design Activism Group and Speculative Futures social media groups and channels. Of this sample, ten design methods and design strategies were selected for more detailed analysis. The selection was based on these methods and strategies' general popularity and familiarity. Furthermore, they included ethicality as an emerging topic. In the thematic analysis, during the coding process, we identified themes that permitted the critical points of the data to be gathered considering Humans, Nature, Technology, Governance & Business, Collabora-

tion, and Design Scope. Once the initial coding was finalized, purposive sampling was conducted on a Miro board, including selected topic-related academic articles to understand these themes further. Memoing supported the constant comparative analysis and inductive analytical process of the data collection while contrasting data, concepts, categories, and theoretical claims while keeping constructive knowledge (Charmaz, 2014).

The generation of a substantive has a broader research objective “Explore the phenomena of designers involving and engaging people in sustainable and responsible technological innovations through Design practice”. Constructivism-grounded theory (CGT) was primarily selected to construct a substantive theory using reflexive analysis and abductive reasoning (Charmaz, 2014), in which researchers’ personal beliefs align with constructivist assumptions. We are currently working with the theory construction based on theoretical sampling, desktop research, and data coding. Next, data collection will be extended to interviews and focus groups with experts in Design. After that, the theory will be co-designed and validated with diverse members of design and business communities. Finally, sustainable and responsible innovation facilitation and design tools will be co-created, selected, tailored, validated, and launched.

Results

The following chapters first present an overview of the sample collection and comparison criteria. Second, the authors interpret the changes in the Design discipline in terms of maturity and scope. Third and fourth, it proposes enhancements in the technological innovation process.

Formulating substantive theory for designing technological innovation

Most recent studies in Design highlight the importance of addressing technological innovation’s environmental and societal implications (Gaziulusoy & Öztekin, 2019). Considering these implications demands expertise in areas that are only sometimes familiar to technology experts or companies that follow a tech-driven innovation process. Moreover, the lack of knowledge about societal and environmental aspects linked to technologies can lead to unintended and unpredicted consequences.

Design can play a role in fostering transdisciplinary (Coulter, 2013) approaches to tackle these complex challenges. Teams of diverse experts engage in a co-creative and participatory process, benefiting innovation facilitation, methods, and tools that support people’s engagement and sense of responsibility towards distributed decisions and commitments to achieve short- and long-term goals with actants in the system.

Design theories and methodologies diverge and follow similar criteria. We used these emerging themes from the theory formation to highlight in this research for comparison, followed by supportive questions:

- Human.
How is human centricity applied? How do identity intersections and pluralism are applied? How values and ethical boundaries are considered? What is the human relationship with other systems?
- Nature.
How is the natural environment considered? What is the proposed vision for natural recovery? How does it suggest mitigating current and future environmental challenges?
- Technology.
How does it support technological requirements and implementation? What is the role of technology in the innovation process? How does it relate to the other systems?
- Governance.
How does it support solution creation and execution? How does it support mindset change and cultural and operational organization transformation? Does it support the decision-making process? Does it build certainty?
- Collaboration.
What are the bases for collaboration? How does it support engagement, accountability, commitment, transdisciplinary, and participation?
- Design Dimension. What is the Design scope? What kind of outcomes are the approaches targeting?

Expanding Design Scope and vision maturity

Growing digitalization is causing an exponential increase in designed products and services. That is why Design is moving towards more intangible and strategic application contexts, and its scope and key aims have broadened (Buchanan, 2007). The Design discipline has also evolved reactively rather than proactively.

For instance, in Design Thinking (Kimbell, 2011), Design is a reflexive act that helps to understand wicked problems in ambiguous spaces. It assumes that the outcomes have multiple meanings depending on the individuals. Tab. 1 shows the results of categorizing dimensions of Design Thinking in six emerging themes in the literature based on authors such as Brown (2009), Kelley and Kelley (2013), and Kimbell (2014).

Human	Nature	Technology	Governance	Collaboration	Design dimension
Searches for tacit and explicit knowledge from prospects and current users of a design process outcome—By empathy, generate more human-centric solutions.	It needs to be intentionally inserted into the thinking. Most authors understand the design's impact on individuals and the environment.	Early interactions with the solutions (i.e., sketches and prototypes) can result in better models (Henry Petroski). It approaches technologies with their characteristics and constraints to modelling content and, often, knowledge manipulations. (How something should be understood)	Ensures the success of the outcomes by involving customers in the design process —customer empathy, customer-centric.	It values human engagement as the ethics of the design process. The understanding of complex problems of design can be improved by demanding participation.	Design is a reflexive act that helps understand wicked problems (exists in an ambiguous space). It assumes that the outcomes of the Design have multiple meanings to multiple individuals.

Tab. I
Dimensions of Design Thinking categorized based on comparison themes and supporting questions.

Service Design proposes integrating organizational un-siloed thinking towards customer touchpoints. Touchpoints are moments of truth and crucial interactions that support customer-organization interactions. Value is created and delivered throughout the service ecosystem and in a continuous and direct dialogue. Tab. II presents the results of categorizing dimensions of Service Design in six emerging themes (e.g., Sanders & Stappers, 2008; Moritz, 2005; Ramaswamy, 2009; Stickdorn et al., 2018).

Human	Nature	Technology	Governance	Collaboration	Design dimension
In addition to the original ideas from Design Thinking which focus on customer/user experience, SD considers services as temporal economic activities that happen over time from the experience life cycle.	Service Design purpose supports ecosystems strategies. Companies in a value network and value chain work together to achieve customer excellence. If targets are ecological targets. Service Design can help to achieve them.	Digital transformation supports creating many digital services and systems to support customer-centric operations. Digital channels are limited and controlled ambients where designers can create consistency and affordances to ease the use and automate processes.	Service Design is a bridge for multidisciplinary work and operations alignment toward customer-lifecycle experiences.	Co-creation is at the core of Service Design, where service and product improvements and innovation are based on the customer's understanding and demand and multidisciplinary teams operating together to fulfil these needs.	Service Design has a strategic approach and tends to take a bird's eye to the service experience life cycle, value chain, and organisational operations; It can also be considered practical as the nature of the work is to find gaps and areas for improvements prioritised towards

Tab. II
Dimensions of Service Design categorized based on comparison themes and supporting questions.

Circular Design uses the Design Thinking approach to explore new ways to create sustainable, resilient, long-lasting value in the circular economy – giving creative confidence to redesign products, processes, operations, strategies, businesses, or even cities. Dimensions of Circular Design were grouped under six emerging themes in the literature (e.g., Takacs et al., 2020; Meloni et al., 2018; MacArthur, 2021), as presented in Tab. III.

Tab. III
Dimensions of Circular Design categorized based on comparison themes and supporting questions.

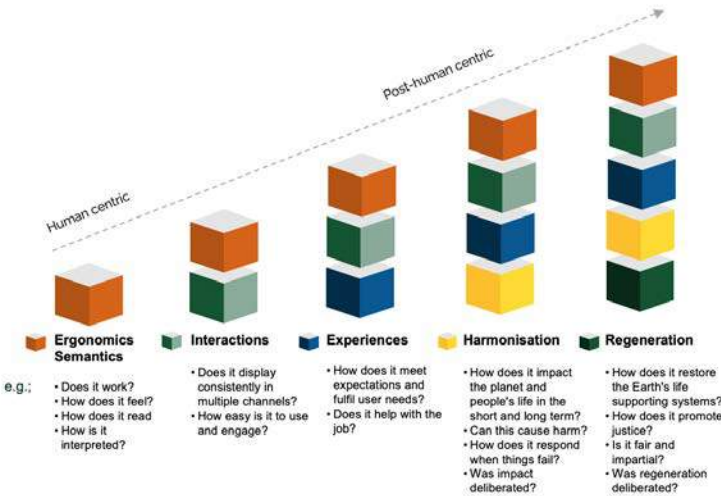
Human	Nature	Technology	Governance	Collaboration	Design dimension
Adopting sustainable and responsible business models and deploying effective reverse cycles is instrumental to realising greater product circularity. Consumers continue to landfill their products after the first use or store them in a closet forever; the impact of better Design is limited. Therefore, there is a need to drive customer behaviour to build an emotional attachment for their devices to have a longer life, and when changing to a new one, the device does not go on the wrong path.	Nature has a passive role and is seen as a victim of our progressive actions and extensive exploitation of resources, pollutive processes, and Industry. Climate change, natural disasters, and scarcity of resources call for businesses to act. Some authors refer to the need to regenerate natural systems to sequester carbon in soil and products. They also say that a Circular Economy is a framework that tackles global challenges such as climate change, biodiversity loss, waste and pollution.	Devices are part of our life, but most are still disposable as new models offer more capabilities than the old ones. These disposal practices lead to the loss of energy, resources, and product value embodied in electronics, generating a vast amount of waste in the process. New devices should contain used and remanufactured components and work as a gateway to cloud adaptability in computing power and memory allocation. Maintenance services to ensure longer life investments in the recycling process to ensure that materials are recovered and reused. Some authors argue that advances in AI, cloud and fog computing can accelerate the transition towards a circular economy at scale.	Rethinking the Design of products is essential to enabling the economic reuse of assets and their components and materials. Shifting businesses to circular operations and product design / inner loops Value and use of components can also be cascaded across industries, increasing investments in material renewal / outer loops. Staffing for the planet is necessary, and new roles and responsibilities tackle and orchestrate circular operations and outcomes. Increasing circular policies - working in conjunction - helps governments build healthier economic recoveries and lower the cost of transition for businesses.	Collaboration also happens in the supply chain/value network as solid partnerships, and ecosystem strategies enable circular practices. Circular Design requires product design, management, operations, and supply chain changes. There is an excellent push for value co-creation internally in the enterprise and at the business network levels.	Circular design strategies fit the business model and the broader system in which the device operates.

Regenerative Design focuses mainly on the co-evolution of two systems, sociocultural and ecological (Cole, 2012). Derived from global and local, glocal recognizes the need to balance the invisible global forces and the real sense of place and culture (Nagashima, 1999). It also characterizes spaces as places with heritage, cultural and national meanings.

Furthermore, other Design approaches were analyzed using the emerging themes and supporting questions. They entailed Systemic Design, Design for Sustainability Transitions, Value Sensitive Design, Design Justice, Biomimicry, Design Council's Beyond Net-Zero, and business strategies such as Planet Boundaries, Doughnut Economics, Sustainable Development Goals, and Wedding Cake, Ten Types of Innovation, Responsible Innovation Framework and Resilient and Regenerative Cultures.

The studies reveal that awareness throughout the design process is growing, embracing a post-human-centric worldview. Still, technological innovation depends on a continuous decision process, often limited and structured by a biased group of wealthy individuals. It is also not enough to think about digital experiences or circular Design in technological innovation; we need to step further in the regeneration of systems to nourish a healthier planet and a more fair and just society. Fig. 1 visualizes our proposal for extending the Design scope and maturity from a human-centric view focusing on ergonomics or semantics, interactions, and experiences to a post-human-centric one considering harmonization and regeneration. Such a worldview acknowledges and builds upon the learnings of the past: ever-growing knowledge and competence enrich the role of Design. Its starting point was Buchanan's (1992) four orders of Design which refer to the different levels of design focus: symbols, products, services and systems, and the other pieces of material in this study. It also uses questions as an example of changing mindset and maturity of Design to tackle the real-life diversity and complexity and impact of innovation on the planet and society.

Fig. 1
Scaling systems awareness across the design scope. Credits: Jane Vita.



Technology as an Enabler for Transformation

Technology has the potential to enable humans to mitigate global challenges. However, if it is not ethically and responsibly implemented, there may be unexpected and unintended consequences, as it follows a paradigm that perpetuates societal injustice and harmful biases. This paradigm must shift from mono-disciplinary and homogenous knowledge production to more collaborative, diverse, and participatory practices (Liao & Muller, 2019).

Regardless of the type of design intervention, be it a product or a service, it is fundamental to view it in its larger context, i.e., the systems it is entangled. The systemic view will pose new questions on who or what is in relationship with the Design; therefore, who should be considered an actant? The systems view crossover design interventions, from stuff to strategy, and technological innovation does not work in isolation. It can only be implemented by considering its connections and impact on other realms, such as society and the biosphere.

The attributes of technological innovation must go beyond human-centricity. Fig. 2 shows our expanded User Experience Hierarchy of Needs model based on Anderson (2011). His model is highly used in human-computer interaction design to define the standard maturity experience we want people to have. The expansion proposed based on the purpose sampling encompasses inclusion, harmonic, and regenerative maturity levels where the charm now is not cross-convenience level but goes beyond human centricity.

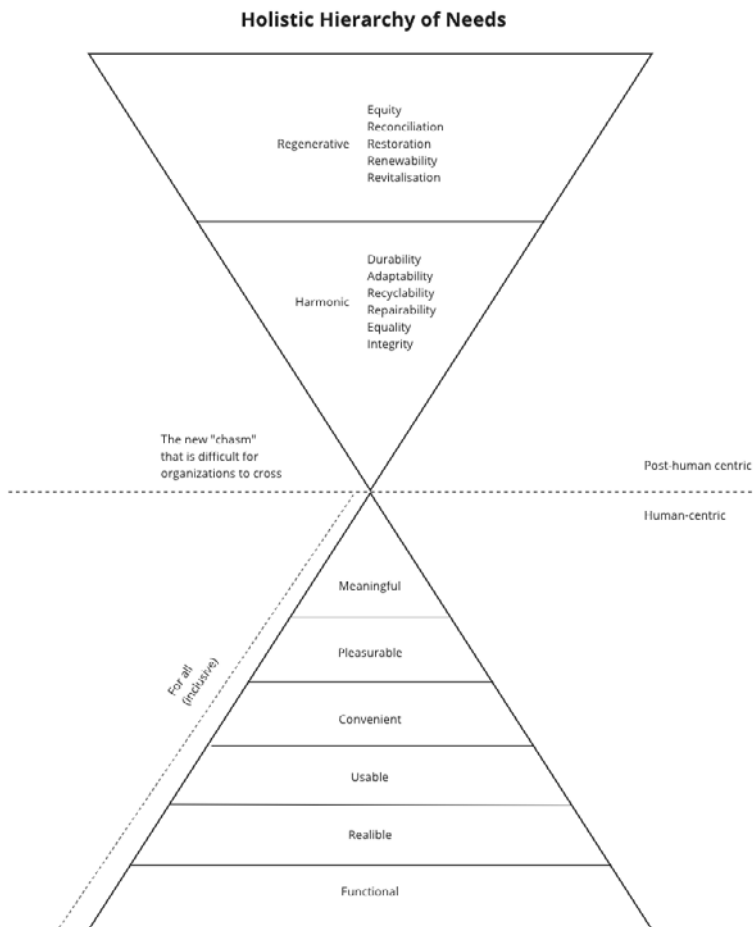


Fig. 2
Expansion of the *Experience Hierarchy of Needs* (Anderson, 2011) to a more holistic needs view.
Credits: Jane Vita.

The bottom part of the pyramid focuses on tasks, functions of the product or service, and features that make it work. Includes tasks that are easy to measure and quantify with straightforward objectives. Towards the top of the bottom pyramid, middle of the diagram, the focus shifts to experiences, which are more challenging to measure as they have more personal significance, requiring a better understanding of people, activities, and context. In the original diagram and explanation presented by Anderson, different people experience different things. However, it does not mention diversity in designing these technological products and services to be more inclusive. We propose special attention to inclusion in this reviewed diagram, from function to meaningful level.

Adding an upside-down pyramid to the diagram shows that designing technological solutions should go beyond human needs and reach needs at the systems levels. Starting from ensuring Harmony, not causing harm, and respecting the existing systems in play to a more just and fair Regenerative impact, reconciling and reviving when opportunities occur. In addition to the levels presented in Fig. 2, human rights and topics such as data access, privacy, and transparency should be considered.

Thinking and acting on needs beyond human-centrism will help organizations uncover needs that will support a positive impact and avoid harm to connected systems, such as the biosphere and society. It is not only about how a product or service functions, is reliable, useful, and experienced, but also about how its production impacts, e.g., employees, customers, and society in the long term, and how it supports health and privacy. It is about how a culture of care and responsibility is embedded in the technological solution process and ways of working.

Dedicating more time to understanding and acting toward a more responsible process and outcomes is needed, as well as measuring and monitoring the ongoing services and product updates and their continued use. As in the ancient Haudenosaunee (Iroquois), The Seventh Generation Principle philosophy (Redvers et al., 2020) declares, “Decisions we make today should result in a sustainable world seven generations into the future.”

At the core of technological innovation are *Agile* and *Lean* methodologies, and their rapid approach does not allow spending enough time considering things beyond the necessary to build. They advocate for a culture of failure but are limited to a biased group that might not intentionally advocate for diverse perspectives and a participatory approach.

Expansive Learning through the sustainable and responsible innovation journey

Responsible businesses foster a caring culture in operations, which leads to more sustainable outcomes. It nurtures interdisciplinary and participatory collaboration with actants in systems impacted by their solutions (Jones, 2014). It acknowledges that people leading businesses and changing mindsets are crucial to contributing to a healthier planet and society.

People involved in the innovation process must be committed, resourceful and skillful, and facilitators ensure this knowledge is diversely produced and shared (Drain & Sanders, 2019), communicated, and embodied in technology design. By cooperating and forming boundary objects (Välk et al., 2020), we provide spaces for sharing learning and skills and inspiring future states.

Methods and tools should support systemic thinking with approaches and clues that consider aspects of diversity, inclusion, planet boundaries, and impact, which people would not access otherwise. The initial phases are recognizing and discovering the systems and actants involved, their relationships, value exchange, and possible implications. Creating constraints and criteria for technological concept creation, solution development, and business strategies with the foundation of sustainable and responsible values is essential to achieving these outcomes.

Expanding and producing knowledge through Design should happen in an iterative, reflective, participative, and respectful process. Fig. 3 exemplifies a more holistic and purposeful Innovation Journey, where the path grows toward care and certainty. Broadening interests in affected systems is necessary to achieve sustainable and responsible results.

In this approach, the reflective and participatory innovation journey begins with planning, mapping, and understanding, identifying focus areas, and reframing the problem. Context is explored through different lenses, considering technological, economic, cultural, societal, and environmental views. In the analysis and framing phase, key topics from each lens are translated into criteria. In describing phase, priority criteria are selected, and the value proposition is reframed. Next, lead to ideating approaches and technological solutions. Turning criteria become a source for creation, and rapid prototyping and validation can begin. In the refining and impact assessment phase, solution requirements are defined. Finally, requirements are tested in user experience testing, and expert evaluations lead to scoping and prioritizing requirements and defining key performance indicators (KPIs).

To complement this, preliminary work on designing the process is crucial (Vines et al., 2013). Participation becomes configurable as an interventionist and reflective practice where new ideas, processes, and perspective lenses are introduced to encourage mind-set change and promote dialogue. Configuring participation and designing the engagement throughout the technological innovation process can support expansive learning (Engeström, 2001) and dialogue around responsible and sustainable practices and outcomes. It is essential to create contact zones (Pratt, 1991) and involve affected communities to future-proof outcomes, where technology is an enabler, not the driver.

We understand that an expansive transformation through learning is required to reach collective responsibility toward new patterns and breaking existing paradigms, which will purposely impact the innovation journey and its outcomes.

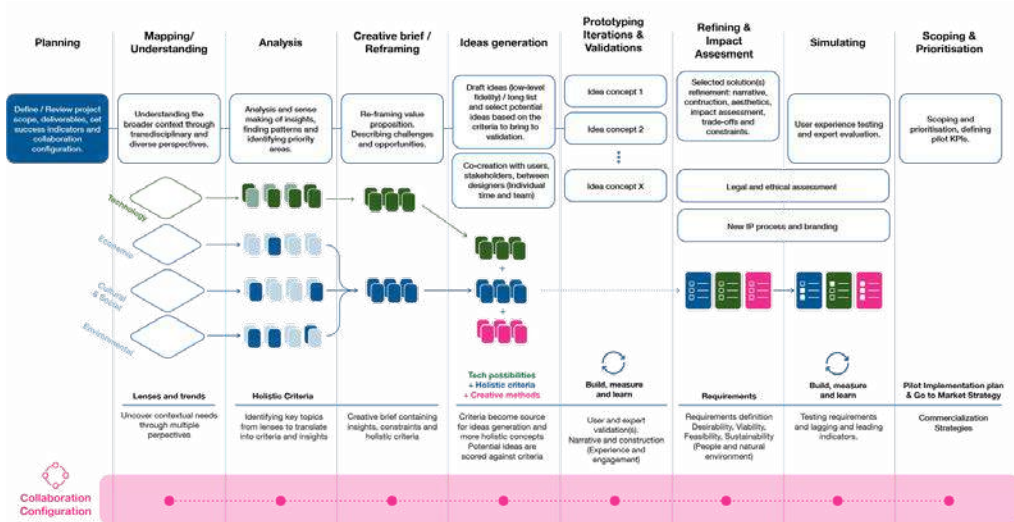


Fig. 3
Reflective and participatory innovation process.
Credits: Jane Vita.

Conclusions

This paper described the formulation of substantive theory and approach for a responsible, participatory, reflective, and systemic design. Further studies will enhance the substantive theory with validation interviews and workshops, including diverse actants, as mentioned previously in the configuration participation of the design research framework. We also intend to validate tailored creative material that can serve as a toolkit to expand knowledge and diverse perspectives in the responsible innovation process. As an outcome, we expect a practical and tailored approach and tools to support the role of Design in technological innovation. The aim is to continuously investigate different phases of the innovation journey to inform, reflect, and produce diverse knowledge to create more responsible and sustainable solutions with humans and nature at the core, supporting impact visualization, risk assessment, and mitigation.

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Track 4

Design Values Out of the Mainstream: New Geographies of Influence

In geographical areas in which there is need today of establishing new economies, production of goods often relates either on traditional craft or imported industrialized plants. They do not see in the design field the chance to innovate objects as narrative tools with cultural reference.

With a wider view towards possible future developments of economies and cultures, the “Discourse of Transition” by Arturo Escobar reaches an unprecedented interest for design: there is a clear difference in forecasting planetary changes related to the Global North, where the debate goes towards degrowth and postgrowth, postcapitalist, posthuman and many other post-industrial ideas of liberation of the “machine”, while the Global South looks towards postdevelopment and biocentric, after a period of self-definition of its position in the world. Acknowledging these areas as new geographies of influence for the world of tomorrow, as driver of a “Civilizing Globalization”, the track welcomes contributions that explore design praxis and research in decentralised areas (i.e. in the Global South) beyond the Mainstream. It wants to showcase projects that establish an independent view on local industry and endemic design strategies, self-construction and craft, which eventually generate new aesthetics and recognition of human being’s skills. Moreover, the narration of experiences related to Advanced Design practices and processes, example of unconventional collaboration and networking, cross-fertilization between design, arts and technologies will complete the panorama of studies and projects of this track.

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Abstract

This essay introduces the topics addressed by Track 4 and explores decoloniality's impact on design studies in developing countries. It addresses Eurocentric dominance in design, the post-WWII shift of design practices to developing nations, and the emergence of the "Design for Development" movement. Case studies highlight design's role in transforming crafts, integrating cultures, and utilizing local materials for sustainability. The essay underscores design thinking's potential for national knowledge economies. It advocates breaking free from Western design hegemony, embracing diverse perspectives, and promoting design as culture.

Keywords

Endemic design
Global South
Crafts
Hybridization
Transition

Introduction

'Decoloniality' has increasingly been of attention and in-depth studies across broader fields of knowledge and practices. Traditionally, design studies are dominated "by a focus on Anglocentric/Eurocentric ways of seeing, knowing, and acting in the world, with little attention being paid to alternative and marginalised discourses from the non-Anglo-European sphere, or the nature and consequences of design-as-politics today." (Abdulla et al. 2019, p. 130). Innovation and creativity are crucial as socio-cultural and economic practices demonstrated their historical transformation from the Eurocentric world into the 'others,' addressing the developing nations since the end of WWII. This transformation is political, it reflected commitments from the Eurocentric powers to fulfilling the basic human needs in the 'underdeveloped' world, as identified at that time. Considering needs as to "providing people with a basic set of commodities... once the basic needs were met, people could thrive. Unfortunately, this was not the case." (Leitão, 2022, p. 5) Also, needs in this historical context continue dominating through many aid programmes presented by national and international organisations that target vulnerable social groups, these are suffering from hunger, diseases, etc., across the developing world. Reviewing the transformation of the modern design context from the Eurocentric into the developing world is the aim of this part of this essay, it will discuss specific socio-political contexts in this transformation to enhance our understanding of the scope and dimensions and to support our discussion concerning presented papers in this track.

European colonising nations and the USA offered assistance to the 'underdeveloped' world shortly after WWII ended. This aid focused on transforming modern production technology from the West to the East to enhance efforts to improve the socio-economic and their reflection on the living conditions in these countries. The United States led this movement through an assistance aid program President Harry S Truman presented in his inaugural speech on the 20th of January 1949: '... we must embark on a bold new program for making the benefits of our scientific advances and industrial progress available for the improvement and growth of underdeveloped areas' (Escobar, 1995, p. 36). The rhetoric of modernisation and development has been extensively promoted by the newly independent Asian, African, and Latin American nations led by socialist political discourse utilised development principles to achieve modernisation, which was defined by Mignolo (2011) as "a want to have a comfortable, middle-class existence with all the amenities and attributes that go along with it—clean water, indoor plumbing, electricity, telecommunications, infrastructure, personal safety, rule of law, stable politics and a good education system." (Mignolo, 2011, p. 52) In this political context, design discourses were promoted in association with their social context, "beginning with the arts and crafts movement in Britain in the 19th century... social engagement was a main driver of design theory from the time of the emergence of the profession of designer in the context of industrialization" (Dorrestijn, 2013, p. 47), and utilised as essential creative practices serving industrial manufacturing production. Furthermore, this

aligned with previous local and international attempts seen in design theory, design education, and professional design practices during the 1960s–70s that stimulated design discourses' core function in social and economic growth through industrialisation (Kulick, 2017) (Papanek, 2018).

Debates concerning the modern role of design practices have continued in the political rhetoric in developing countries since the 1970s, responding to the expanding demands for materialisation and its signifying characteristics in the empowerment of social groups. According to Bonsiepe (2006) “the excluded, the discriminated, and economically less favoured groups as they are called in economist jargon... [amount] to the majority of the population of this planet.” (Bonsiepe 2006, p. 30) This is applicable to the scale and types of technological knowledge transforming developing countries, supporting the need for design practices to engage and effectively utilise these new technologies. However, new technologies are divided into hardware and software; that is, “technology implies hardware and software—and software implies the notion of design as a facet of technology that cannot be dispensed with” (Bonsiepe, 2006, p. 32). This definition supports the role of design in industrialisation, as well as its role in socio-political capacities to create a path toward the democratisation of society and to “provide for a broad sector of the population to have access to the world of products and services in the different areas of everyday life: health, housing, education, sports, transport, work, to mention only a few” (Bonsiepe, 2006, p. 32).

Responding to late 1970s political debate, the ‘Design for Development’ movement was introduced politically when the ‘Ahmadabad Declaration’ was issued in India in 1979. The declaration resulted from joint efforts between the United Nation Industrial Development Organization (UNIDO), the International Council of Societies of Industrial Design (ICSID), and the Indian National Institute of Design (NID). The document explicitly proposed the design engagement with development as the right way to approach design in developing countries. Additionally, the document marked the “first time that industrial design had been suggested as worthy of inclusion in national development plans” (Coward, 2005, p. 545). The declaration's major principles presented (1) Design is “a powerful force capable of improving the quality of life of developing countries' populations. (2) Designers should understand and recognise the values of their societies and reflect them in their designs. (3) Designers should utilise both local, traditional resources and modern science and technology. (4) Designers should collaborate with one another to ensure that collective identities are preserved and the priorities of these collective identities are met” (Ahmedabad Declaration, 1979).

India was characterised as one of the ‘non-aligned’ movement's founders and leadership countries, as was Indonesia and Egypt at that time, which influenced ideologically and politically the establishment of the ‘Ahmedabad Declaration.’ As Margolin (2006) argued, “It was in the spirit of an aggressive call by the developing countries to restructure the world economy that the Ahmedabad conference was held and the declaration was produced” (Margolin, 2006). However,

the 'Ahmedabad Declaration' continues to maintain its position as the only official document at the international level that articulates the strategic role of design discourse and practices in supporting the development of developing countries. Additionally, the document articulates the spirit of modernity in the political context by shifting design from its local and traditional context toward enhancements in the modern context. Ahmedabad Declaration principles have been implemented through design education and professional design practices in many developing countries since its establishment, specifically in the discipline of industrial design. In fact, it was the force factor to support industrialisation as a socio-economic sector, which got further attention during the 1980s in many of these countries. As Parsons (2016) writes:

“What the Modernists sought, therefore, was not to turn design into ‘fine art’ or tradition-based craft, but to blend the best elements of traditional craftsmanship, modern mass production and fine art into a new way of producing material goods that made sense in the social context of contemporary life” (Parsons, 2016, p. 46).

While the nature of interdisciplinary knowledge and practice that culminated in the design process in terms of innovation, visualisation, production, promotion, and marketing was enforced. These practices identified design as a micro-element within industrialisation and production processes, “design is a prefigurative practice of applied imagination that goes ahead of bringing ‘a something’ into being.” (Fry, 2020, p. 42) Also, the nature of design practices overwhelmingly shows that design plays a macro role in efforts to achieve human development goals, especially in developing countries. Such arguments support the value many governments placed on addressing and elevating design as a strategic factor in their development planning. New waves of policies—the ‘design policy’ or ‘design and innovation policy’—utilised design discourse as a core for strategies toward implementing and promoting the country. Additionally, the power of design has been identified in relation to national economic growth. Accordingly, further new waves of design policies have been issued in countries such as Estonia, India, New Zealand, South Africa, and many more.

Case studies over the mainstream

With this background of a decade-long gaining consideration of design as a strategic factor in their development, design discourses in developing countries reached out to different applications and analyses of valuable improvement of utility in most fields of life. The papers of this track are trying to put light on some of the case studies that try to emerge the role of design in this long-term change of craftsmanship and popular culture up to game-changing performances for entire governments, while cultural affordance towards embedded local values matches the single identities.

Hoda Aman works out the difficulties of transformation and related risks of deviating the aim of craft into “its transformation into an ornamental commodity that failed to fulfil its functional requirements” by then continuing that “the craft is produced from a touristic perspective, to serve the elite, not the public, separating it from the local community and losing its cultural specificity”, asking herself of what kind of final destiny the craft will eventually have. By describing different case studies of design in creative industries in Egypt, she concludes that the results all differ, “But all of them agreed that the political conditions, the general orientation, the competitive economic climate and the infrastructure provided by the state, greatly affect the growth of the experiment or stop it”. This political dimension of design as a tool for economic growth, however, often can be used as an excuse for low initiative by local craft clusters, pushing away the unsuccess of their actions, arguing that the government is not providing support, because of low tourism, no organised sales channels like markets and so on. Another problem pointed out is industrialisation and mass production, which makes craft products a niche product with low-quality control, which furthermore results in more expensive as long it takes longer time to realise the items. None the less, as a political tool remains, the importance of “employing a lot of workers in villages and small cities, as well as there are many initiatives interested in activating the role of women in society because there are many crafts that these women from the local community work in”.

Exactly this point becomes an important element in “Culture-based Innovation: A Localized Approach for Designing”. Crafts in many developing countries are a widespread micro-economy that is not only interesting for tourism in search of eye-catching ethnical gadgets. For Alaa Elanssary and Ahmed Wahby, “handicrafts (...) offer a quick and short monetary cycle, and most of all it is a reflection of the local culture and identity.” For this reason, “globally, cultural inspired designs can easily be trendy and fashionable.” With this approach, the task falls back to the designer primarily, as long as supposing a craftsman will not have the ability to deal with global trends. “Designers need to expand their experiences not only with cross-cultural factors but equally important is the knowledge of local elements”, facing the dilemma of “inexperience of most designers with cultural integration, and the difficulty of designing for many cultures at once.”

By giving the craftsmen the title of heroes, “as they are the designers and marketers at the same time”, they arrive to conclude of the need for Design Marketing as a tool to promote in the market, as the sole craftsman is not able to run all on his own. An essential finding in their analysis is that besides the deep cultural knowledge by the designer to innovate sensitively in the given context, “the innovated products encompass not only the form, but also the function whether traditional, added, or introduced. Furthermore, the production material and techniques should be given prominent care.”

With this last finding in mind, the maxim “form follows function” in the context of developing countries and the use of crafts-knowledge could transform into “form follows material”. But looking deeper, we can look at the proposal “Design Resistance. Material Solutions for local remoteness”, understanding the importance of local materials as a core element in the definition of artefacts, with its functional-environmental relation to local climatic conditions as well as its availability for authentic sustainability. Martina Taranto, Barbara Pollini and Valentina Rognoli address in their paper “Decentralised areas by analysing the project called Viral Nature, a material research and design of a composite material able to host vegetal life and attract biodiversity, (...) formulated as a potential design intervention against soil degradation and desertification.” The approach is going further into the study of available resources of developing areas as an opportunity for innovation of a different kind: acting as unexplored local resources, design can bring innovation beyond cultural approaches, yet “practice of material design might need to rely on indigenous narratives and tangible solutions of Lo-Tek design that mould the design exercise into endemic design responses.” Accordingly, the local narratives are the trigger of the use of new materials, because “isolation, social and physical remoteness, the decentralisation of creative forces have steered the direction of the design discourses and its urgencies, which now proceed towards ecologically and eco-systemically driven narratives”. So to say, citing Carl Magnusson,¹ “good design is not about form following function. It functions with cultural content. By adding “cultural content” to the concept of “form follows function,” objects cease to be finite or predictable.” Meaning that cultural content at the very end is a narration.

Being able to use local resources to generate raw materials which are useful for production becomes more and more an important challenge to fight marginalisation of isolated places. Due to geopolitical reasons and crisis of any kind, the lack of raw materials leads immediately to deeper disasters: “Nowadays, the leading causes of rural marginalisation have not only to be ascribed to geography but to the “lack of access to resources [...] resulting from a lack of socio-economic and political connections (‘connectivity’) and, hence, of relational ‘remoteness’”. Annalinda De Rosa and Davide Fassi in their contribution “Culture and creativity as assets for inclusive growth in small and remote places: a design-led process” go further in this path of thoughts, introducing the action-research project called *SMOTIES - Creative works with small and remote places*; it

“aims at identifying and activating possible trajectories for a local evolutionary pathway, leveraging existing minority excellence niches. (...) The cultural and creative sectors not only offer social benefits (such as improved well-being and community cohesion) and economic benefits (through local taxation, job creation, innovation, and supply chains), but they also contribute to place-making by making cities and regions more desirable places to live and work, thereby promoting inward investment, inward labour flows, higher productivity, and increased tourism.”

In this way, the design process passes from intervening with local craft culture to an overlooking system of opportunity creation for entire communities. Not necessarily related to poor countries, the approach opens up to “another kind of global south”, the one which relates generally to under-developed areas. The project “will significantly improve the capacities of remote places to become part of a transnational network thanks to newly created synergies while being firmly embedded in the local context and establishing an innovative view of the local creative industry and endemic design strategies.”

Yağmur Gizem Avcı, Ece Cinar and Çiğdem Kaya explore practically this approach in south-eastern Turkey. The paper “aims to use traditional knowledge as a source for sustainable development and a sustainable way of living by examining, empowering, and promoting local and traditional values through social innovation approach and design expertise. The main motivation of the study is to construct an intended link between traditional knowledge and a sustainable future for societies.” Based on the principles of participatory design, an in-depth analysis of the current situation of local craft production, they can define that “there is an unknown and uncontrollable relationship between women producers and suppliers of additional resources. This situation creates an unknown background for products. To prevent this, to evaluate and associate local resources and labor in a more controlled way, the second proposal framed as a ‘new ecosystem for symbiotic production process’ to empower and transform the local sources into a networked community.” It ends up creating new communities and, eventually, cooperatives that are able to optimise knowledge with resource networking in local contexts.

Halim Choueiry proposes this kind of design intervention on the level of the entire government, introducing the methodological approach of Design Thinking in Bahrain, a small but oil-rich Kingdom in the Gulf Region. Design Thinking “was at first described as a collaborative process, and later, as a human-centred approach to innovation,” and the author explores the “possibilities of using Design Thinking as the main tool to establish an infrastructure towards a national knowledge economy.” As a forecast of the new economy, sustainability and understanding that welfare based only on petrol has a predictable end, the government declares to shift “to a productive, globally competitive economy, driven by a pioneering private sector, embracing the principles of sustainability, competitiveness, and fairness.” This example could demonstrate that for geographies out of the Anglo-European sphere, as introduced at the beginning of this contribution, the main goals of the Ahmedabad Declaration of 1979 are also applicable in an extended context not related to economic inferiority but to a static situation where society as a whole did not develop further than a status quo through decades. Design proves to be a driver for mainly social, cultural and sustainable innovation.

With its capacity for self-reflection and multidisciplinary approach with no preliminary borders, “design is among the contemporary disciplines that are most deeply identified with the twentieth century. While recognising the need to constantly redefine its field of action and boundaries, its mandate, and its cultural, social, and political

responsibility, design seems to be the engine of the current world in which we are living, reflecting itself in the changes and deep upheavals have taken place over the century." Fabiana Marotta, in her "Burning approaches to tensing the present: a new political dimension of design", emphasises the all-disciplines-embracing character of design as a tool of the XXI century. Still, the question remains: "Is it still possible for design to glimpse collective narratives that take on a critical value and stand as an extraordinary opportunity for the re-signification of the world and the small things with which man is related?" Especially referring to the Global South, design needs to overcome the mindset of a colonised geography, that is still marked in its stigmas of "racial and sexual system of social classification, a binary epistemology that opposes high and low, spirit and body, head and feet, rationalisation and emotion, theory and practice".

Another approach of looking at marginalized design policies could be the interpretation of the contribution of "Cultural Factories: Conversion of Industrial Areas into Cultural Hub" by Bruno et alrri. Starting with the idea that "abandoned industrial centers, for which redevelopment, restructuring and functional adaptation are urgently needed, can offer the development of engaging services focused on the territory's characteristics", the design task is needed to focus on territorial specificities and local community needs, and cannot "just" go over very delicate eco-systems with a global design receipt. Thus, "cultural services are the fil rouge linking the whole research through different geographical locations, material cultures and manufacturing production" and analysis of international case studies however underline the capacity of design to respond on specific local characteristics that will make success to abandoned and decentralized industrial areas.

What is happening in an Industrial Design context in a technology follower company – which is necessarily the case in most of the geographical areas out of the economic and R&D strong regions – explores the contribution of Tuncer Manzaköğlu: technology research is unfortunately limited to choosing the core components from global suppliers to set up the best configuration. Nevertheless, following renown models of design methodology and adapting them to the specific context, it leads in best case to gain competitiveness through design leadership achieving a strategic level of design management.

To conclude the proposals of papers that tackle the complex topic of the political role of design to contribute strongly to the development of strategies for geographical areas out of the Anglocentric/Eurocentric focus, the proposal of Paula Visonà, Mágda Rodrigues da Cunha and César Kieling arrive to state that the Global South eventually "came to be seen and recognized as a space for the generation of independent/authorial products, contributing to the recognition of cities outside the creative Eurocentric axis." It should be understood by itself that design practice will contribute on the one side and be influenced on the other side by its own role of mediator between global trends and visions and local answers to specific community needs, sometimes speculative-radical, sometimes traditional-functional.

Conclusions

Once more, turning back to Oscar Magnussen's statement, "By adding cultural content to the concept of form follows function, objects cease to be finite or predictable", a concluding definition of "Cultural Affordance" could try to set the final point. Affordance emerges from interaction with the product and the system: related to culture, it can show the difference between tradition and contemporaneity but points out the essence of rules in design to generate a renewed (cultural) meaning. The given context (environment, community) to the existing local value system of directly and indirectly perceived layers of knowledge and habits leads us to the horizon of interpretations of Global Civilization which needs to be detected, understood and analysed, resonated and repeated in a way that we could go beyond. To go beyond universality or global, dilemmas we face as individuals and communities, while we agree on the universality of human aims, dreams and intellectual destination, we also agree on context-dependency and different conceptualisations of those intentions. And that is how diversity and cultural richness of the design experience comes into mind, starting from the Global South.

The current context of design knowledge and practice is facing major epistemological and cultural challenges. The dichotomies of the Western hegemonic paradigm have so far limited and distorted the perspectives of endogenous design cultures and local knowledge from the "peripheries." However, there is a growing awareness of the need to embrace a plurality of knowledge and a multipolar view of the geopolitics of knowledge.

In this context, design practice is trying to reconnect with endogenous and endemic practices and open spaces for new interactions and contributions from different cultures and epistemological perspectives. It is crucial to overcome the hegemony of global design practices in the Global North and to foster the participation of researchers from non-Western educational systems in the design debate and narrative. The 8th International Forum Design as a Process represents an excellent example of community-led knowledge targeting the Latin Network and Global South countries. As presented earlier, in a geopolitical analysis of the global knowledge ecosystem affected by ethnocentrism, we propose cultural local knowledge and endogenous design as potential solutions to subvert the current Western hegemony. Since 2008, the Latin Network has aimed at disseminating and developing design as culture in our society, addressing tangible and intangible environments covering the Latin American area and the global south in general; this model of networked perspective offers a new frame of knowledge accessibility.

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An Analytical Study to develop the Traditional Craft in the field of Creative Industries in Egypt

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Abstract

The production of traditional crafts in Egyptian architecture, especially Islamic architecture, has been historically significant, reflecting cultural uniqueness. However, political, economic, and industrial factors have led to a decline in craft production, diminishing their cultural distinctiveness (Abdul Hamid, 2001). Traditional crafts currently face stagnation, lacking modernization in design, functional integration, and technological advancements. Artisans struggle to compete with imported products. This research aims to preserve and revitalize traditional crafts by integrating them with the creative industries. It explores modern Egyptian experiences, traces the craft's development, and identifies key points for creating creative products. The study evaluates Egyptian models that introduce new products, assessing their suitability and overall development, including impacts on craftsmen, products, and the production process. The application of creative industry principles is also examined. Findings inform proposals and recommendations to preserve traditional crafts in Egypt and explore their local and global development potential.

Keywords

Creative industries
Traditional crafts
Cultural industries
Egyptian architecture
Crafts guild

Introduction

Traditional crafts are an important part of Egypt's architectural heritage, spanning from the Pharaonic era to the present, with significant contributions to Islamic architecture. These crafts encompassed a range of skills that seamlessly integrated functional and aesthetic requirements into architectural products. Craftsmen in Egypt possessed engineering knowledge, expertise in mechanisms, and implementation techniques, forming the backbone of the architectural system (Ibn Khaldun, 1377). The design process extended beyond aesthetics, prioritizing efficient manufacturing and execution to fulfil its intended purpose. Despite the continuation of various traditional crafts in Egypt today, they face stagnation and crises due to outdated designs and a lack of adaptation to modern technologies. These crafts no longer satisfy functional needs, merely catering to the tourism industry. The influx of Chinese imports has further compounded the challenges faced by local artisans, exacerbating the crisis. Crafts have transformed into an industry, disregarding the aesthetic aspect of architectural production and the development of craftsmanship. Moreover, the absence of specialized industrial education that imparts essential implementation and production skills has contributed to a decline in the quality of architectural outputs during the design and execution phases (Okhasha, 1994).

Background and Context

Traditional crafts in Egypt experienced a period of great prosperity during the Fatimid era, which continued into the Mamluk era. The craft movement reached its peak during the Mamluk era, fueled by political stability and economic prosperity, resulting in a flourishing of Islamic architecture and crafts in Egypt. Several key factors directly contributed to the flourishing of traditional crafts during this time.

Factors Contributing to the Flourishing of Traditional Crafts in Egypt:

These factors collectively contributed to the rise and flourishing of traditional crafts in Egypt. The integration of vocational education, craft production, political stability, economic conditions, societal appreciation, and the preservation of crafts through professional inheritance formed the foundation for the success of traditional crafts.

Political and Economic Stability

Political conditions and their impact on the economic and commercial landscape played a significant role in the development of traditional crafts, particularly in architecture. This led to increased investments in architecture, crafts, and arts. The rulers of Egypt, with their power and financial capacity, played a pivotal role in nurturing the arts. (Al-Sayed, 1996)

Craft Guilds and Vocational Education

During the Mamluk era, craft guilds emerged and thrived, exerting a profound influence on traditional crafts. These guilds served as responsible entities for education and craft production, representing artisans before the state. They safeguarded the rights of craftsmen, ensured the fulfilment of their duties, and provided stability. This stability allowed artisans to focus, innovate, and pass on their craft skills to future generations (Aalam, 1991).

Crafts Education and Professional Inheritance

The keen interest of Muslims in crafts education, along with the practice of professional inheritance, contributed to the flourishing and preservation of traditional crafts. famous educators like Ibn Khaldun and Abu Hamid al-Ghazali emphasized the importance of diverse industries and professions, recognizing their significance for individuals and society. Sons inherited their fathers' professions, learning from an early age through workplace coexistence and companionship. This practice, driven by parents' desire to ensure family livelihood and workshop continuity, played a crucial role in the development and success of crafts (Okhasha, 1994; Suleiman, 2006).

Factors and Implications of the Decline of Traditional Craftsmanship in Egypt

The decline of traditional crafts in Egypt can be attributed to various factors shaped by historical events, political and economic challenges and changes in crafts education, all of which have had significant implications for the state of traditional crafts in Egypt.

Political and Economic Factors and Impact of Ottoman Conquest

Political and economic challenges during the Ottoman and Mamluk eras disrupted craft production. Skilled craftsmen were deported to support Turkish industries, leading to a loss of artisans. The Ottoman conquest introduced limitations in industrial progress, and craftsmen resorted to imitating foreign designs. Muhammad Ali's focus on modern industries and appointment of Turkish administrators further disrupted the traditional system and led to the closure of craft shops (Ali, 2003).

Influence of British Occupation

The British occupation suppressed local industries, promoted foreign imports, disrupted trade routes, and influenced consumer needs. European taste and architectural styles replaced traditional Arab approaches, hindering the growth of traditional crafts. Foreign capital monopolized major industries, controlling wages, and dimin-

ishing the popularity of local crafts. The decline of traditional craft in Egypt can be attributed to various factors shaped by historical events, political and economic challenges, foreign occupation, and changes in education. These factors have had significant implications for the state of traditional crafts in Egypt (Abdulaal, 2002; Hanna, 2003).

Deterioration of Crafts Education

The separation of vocational education from traditional crafts and the emphasis on modern industrial methods during Muhammad Ali's era led to a decline in craft skills and knowledge. and after the British occupation worsened the situation through the abolition of free education and reduced spending on vocational training (Ali, 2003).

While traditional crafts have been regarded as unattainable heritage, global trends have recognized the need to modernize industries and transform them into creative industries. Despite advancements in manufacturing techniques and technology, individuals still seek products that cater to their aesthetic desires and embody manual craftsmanship. Creative industries have introduced a new approach to cultural industries and local identities, aiming to incorporate their vocabulary within a contemporary technical framework.

Through these creative industries, Islamic vocabulary and motifs have been reintroduced in various innovative ways in both design and implementation. This has facilitated the emergence of new ideas that foster the development of traditional crafts, providing a pathway for their evolution in a modern context.

Creative Industries

The concept of creative industries revolves around creativity, which drives social and economic change and serves as a competitive advantage for society. It encompasses various cultural projects, such as publishing, audio-visual media, cinema, music, artefacts, cultural heritage, museums, historical sites, folklore, events, libraries, and software design. Architecture, design, and crafts are part of creative industries, that rely on creative individuals. These industries interact with consumers, allowing feedback for product improvement. Cultural industries are closely linked to creative industries, relying on creative products resulting from design, architecture, crafts or arts (Hartley, 2005).

The Creative Industries Components

For the establishment of creative industries, certain factors must be present. These include:

- 1 Research and Market Studies: Conducting research and studying the society and market where the industry will be established is crucial.
- 2 Fostering Creativity and Innovation: Government agencies and universities often play a role in nurturing talent and supporting creative industries through research and development costs.
- 3 Infrastructure Support: It is essential to have legislation and laws that protect intellectual property, support individual and collective initiatives, and provide financing for small and medium enterprises. Additionally, a free and open economy is beneficial for creative industries.
- 4 Aesthetics of Marketing: Paying attention to marketing aesthetics is crucial for presenting products and merchandise in an attractive and visually pleasing format.
- 5 Creativity is a fundamental aspect of creative industries. It encompasses four components: the creative person, the external conditions, the creative processes, and the innovative product. These components interact and influence each other, making it necessary to study and analyze them together (Hartley, 2007).

The creative products

A creative product can take various tangible or intangible forms, such as industrial inventions, scientific methodologies, skill development, distinctive services, or innovative problem-solving ideas. It involves using groundbreaking materials, techniques, and connecting previously separate elements. Evaluating a creative product focuses on three main aspects: novelty and originality, utility and suitability for its purpose, and structural details encompassing aesthetics, elegance, appeal, and overall quality. The ability to incorporate precise and diverse details into an idea is also important (Raafat, 1997).

To assess the overall success of a creative product, we examine the extent to which it meets these three criteria. In the case of architecture, when the recipient effortlessly satisfies two of these creative criteria, it indicates a successful integration of form and content. Consequently, successful architectural products fulfill the second criterion of creative products by delivering value and usefulness. This is achieved through the incorporation of functional and structural aspects in architectural components. Architectural creativity is thus accomplished by applying innovative thinking to a distinct idea and implementing it in one or more elements of the architectural product. and according to that the case studies chosen and analyzed (Hartley, 2007; Raafat, 2007).

Research Methodology

To achieve the research goals and fulfil the main objective, the following methodology was employed:

- Overview of Traditional Crafts in Egypt including their current state and their challenges. This involves reviewing previous preservation efforts and understanding the factors contributing to their decline. Additionally, the transformation of traditional crafts into industries and the impact of mechanization are explored. The emerging trend of creative industries, which integrates crafts and industries to produce innovative products with global and cultural significance, is also investigated. The aim is to extract general principles from these creative industries.
- Data Analysis and Evaluation: The collected data on traditional crafts in Egypt, as well as the case studies, are analyzed to assess the current state of the crafts and their level of development. This analysis aims to identify the potential for further advancement. The data is examined by presenting Egyptian case studies that aim to add new value to the traditional craft sector. The analysis begins by presenting the basic data of the study cases, followed by an examination of the production process in three levels: learning and acquisition, production mechanisms (including design methods, machines, techniques, and raw materials), and methods of marketing and product presentation to the community. The features and characteristics of the case studies that are deemed significant in developing the level of craft production in Egypt are extracted and discussed.

Egyptian Case Studies (Encode-Rhimal)

The case studies selected aim to add value to traditional crafts in Egypt and fulfil the goal of being considered creative products. The selection process followed specific criteria to ensure the chosen cases aligned with the concept of creative industries and showcased preservation and development methods.

Focus on Handicraft Industries: The first criterion focused on handicraft industries specializing in wood products, primarily located in Cairo. This choice was made to examine the state of traditional crafts that have persisted over time, with Cairo being the governorate with the highest concentration of traditional industries.

Unconventional Preservation and Development Methods: The second criterion aimed to identify cases that presented unconventional methods of preserving and developing crafts. These cases emphasize creativity and innovation in the preservation and advancement of traditional crafts.

Functional and Aesthetic Products: The third criterion aimed to showcase cases that produce products with essential applications, fulfilling both functional and aesthetic aspects. The selected products go beyond heritage value and resonate with practical functionality.

Geometric Formations and Islamic Decorations: The fourth criterion focused on cases that feature geometric formations and Islamic decorations, which hold historical and cultural significance. These patterns have evolved over centuries and demonstrate innovation in engineering and mathematical relationships.

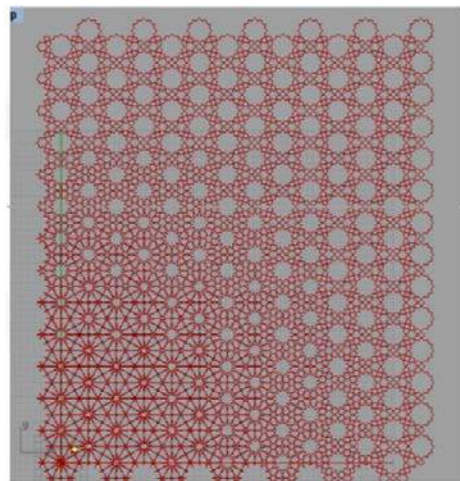
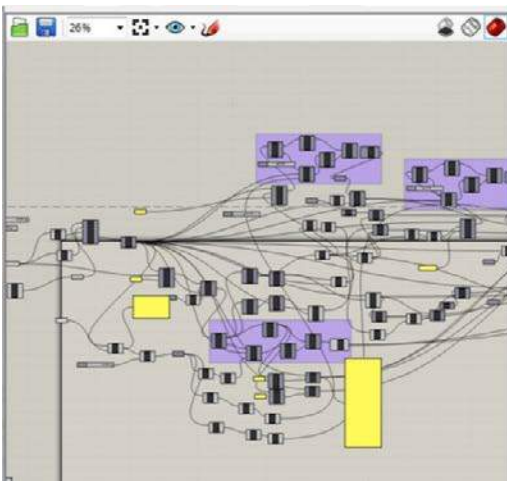
The selected case studies primarily relate to architecture and interior design products to showcase how traditional crafts can contribute to the built environment and interior spaces.

The analysis of the case studies will focus on three crucial aspects: the design stage, the production stage, and the presentation stage, including marketing and target users. This analysis aims to extract the most important features and characteristics of each case study and explore their potential to enhance the level of craft production in Egypt.

First case-study (Encode)

The Egyptian Node for Collaborative Design (ENCODE) is a research and design center focused on developing local designs and products using computer programs and modern digital manufacturing technologies. ENCODE emphasizes research, communication, and collaboration with partners interested in the field. Established in 2011 in Alexandria, Egypt, Studio Encode aims to innovate the traditional production model by blending education, practice, and practical application. They collaborate with universities and factories, offering ideas and products in architecture, interior design, and furniture. In the short term, Encode Studio aims to introduce parametric design as a new language for design in Egypt. Parametric design involves using computer systems and mathematical analysis to generate and develop contemporary designs in two-dimensional and three-dimensional forms. This approach facilitates the translation of computer models into practical applications, overcoming the limitations of traditional manufacturing techniques.

Fig. 1
Designer:Encode studio ,
sample of Encode working
to generate the patterns
by using Cad programs.
Copyright <http://www.encodestudio.net>



Target group of their work: designers rather than craftsmen; their efforts attempt to provide a creative environment through interactive workshops, courses, research and education of new methods of design in Egypt and making industrial prototypes for products that help the designer to understand, implement and develop.

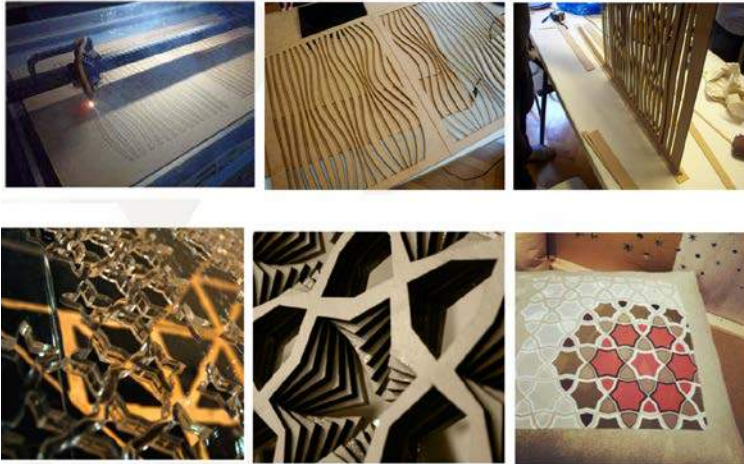


Fig. 2
Designer:Encode studio,
sample of Encode working
through the production
process and final Products.
Copyrights @<http://www.encodestudio.net>

Techniques used for production: Digital manufacturing technology has been relied upon, which does not require manual intervention except at the end for finishing and assembly; They also tried to find new uses for available resources.

Marketing and after sales: ENCODE stops at the initial implementation and making an industrial model, after which the manufacturers that take their designs take over the formation of a production line and implement it with their technologies.

Second case-study (Rhimal)

Rhimal Design is an institution focused on bridging the gap between design and industry in Egypt and the Middle East. It aims to raise the level of design, enhance the competitiveness of local production, and position Egypt globally in industrial design.

The idea originated when a group of young leaders took charge of the manufacturing and furniture sectors in the Egyptian government's Ministry of Industry and Investment. They observed that despite the expertise of the wood and furniture industry in Egypt, it struggled to keep up with global competition in design development and lacked strong export capacity.

Rhimal identified the root cause as the lack of connection between design and industry. To compete effectively, a new and innovative product with global design is crucial, and the reciprocal relationship between design and industry is necessary. When the industry recognizes the benefits of design, it invests in design and designers, enabling them to develop and compete.

Rhimal's objectives revolve around four main axes. Firstly, it aims to promote design as a cultural aspect through effective education strategies to raise public and professional awareness of its role and importance in industrial development. Secondly, Rhimal acts as a bridge, connecting local and international designers, makers, decision-makers, academia, and society. Thirdly, it seeks to encourage and support young designers with global aspirations. Lastly, Rhimal aims to establish an international presence by engaging international names and brands to sponsor and support local design while providing necessary contacts, support, and services for designers.



Fig. 3
Rhimal, Part of the workshops and workshop exhibition. Copyright & Source :www.rhimal.com/incubator.html

To address this problem, the Industrial Modernization Center provided financial support to the Furniture Export Council and promoted the significance of design in the industry. The Furniture Export Council turned to Rhimal to develop and implement a strategy to create innovative design concepts and products that cater to the global market while leveraging the capabilities of Egyptian factories and embracing the country's goals and cultural identity. The aim is to build an international brand for Egyptian products characterized by a unique style that reflects their cultural identity.



Fig. 4
Rhimal, Products of the 1st workshop under the supervision of Rhimal and IDE- Retrieved from 2011-www.anotherarchitect.net/portfolio/tedxberli, www.designindaba.com/news/soundscape-tabletop



Fig. 5
Rhimal, Part of the products of the second workshop and products of local designers at 20+ Egypt. Source & Copyright: www.efecfurniture.com, www.archinfo.it/20egypt-designademuizstreet-ilcairo/0,1254,53_ART_1985,00.html

Target group of their work:
designers, craftsmen, manufacturers.

Launching creative design ideas without placing restrictions on the role of the designer in developing these ideas by transferring his experiences to the trainees to convert their ideas into products, and this comes in an interactive manner that includes the designer, the trainee, the craftsman or the executing company. They tried to establish a creative industrial structure where new designs and ideas, training centers for craftsmen, interactive workshops for designers and producers, forming brands, searching for support and financing for development and providing raw materials, machinery and expertise, in addition to cooperating the government to establish centers for preparing workers and developing their performance to deal with modern technology without neglecting to learn manual skills.

Results

The analysis reveals important findings and recommendations for the current state and development of traditional crafts in Egypt.

Current State of Traditional Crafts: Traditional crafts made of wood and metal industries remain significant sources of employment. However, challenges like mechanization, waning interest among younger generations, and a need for modernization persist. Preserving traditional crafts is vital for cultural heritage.

Impact of Innovative Approaches: Case studies like Encode and Rhimal showcase innovative approaches that integrate modern technologies and design methodologies. They demonstrate the potential to elevate design standards and enhance local production's competitiveness.

Opportunities for Development: The case studies highlight opportunities for developing traditional crafts in Egypt through the application of creative industries principles and modern techniques. Digital manufacturing technologies offer precision and efficiency. Collaboration and incorporating functional aspects and Islamic patterns add value.

Recommendations

Support and Funding: Provide support and funding from government entities, NGOs, and private stakeholders for research, education, and training programs focused on traditional crafts.

Education and Skills Development: Establish specialized training centers and integrate traditional crafts into educational curricula to raise awareness among younger generations.

Collaboration and Networking: Facilitate platforms for collaboration and knowledge-sharing among designers, craftsmen, manufacturers, and stakeholders.

Market Access and Promotion: Develop effective marketing strategies to promote traditional crafts locally and internationally, collaborating with the tourism industry.

Policy and Regulation: Formulate policies and regulations to protect and preserve traditional crafts, ensuring sustainability and maintaining quality.

Author's Notes

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Enhancing Social Well-Being Through Social Innovation Approach and Design Expertise: A Case Study for Social Innovation in a Local District in Turkey

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Abstract

Design-driven scenarios can play a critical role in enhancing social and environmental well-being and creating sustainable solutions for better living conditions and sustainable futures. With this starting point, this study aims to use traditional knowledge as a source for sustainable development and a sustainable way of living by examining, empowering, and promoting local and traditional values through social innovation approach and design expertise. The main motivation of the study is to construct an intended link between traditional knowledge and a sustainable future for societies. The research was conducted by examining a multi-cultural local district in Turkey and its traditional and sustainable habits and proposing development ideas based on the social innovation literature and authors' design expertise. The proposed ideas involve different approaches such as an ecosystem that promotes co-creation, women's employment, symbiotic production processes, and digital marketing platforms for local products.

Keywords

Social innovation
Traditional knowledge
Sustainable futures
Sustainable development
Design expertise

Introduction: Need for action

In today's environmental and social context, every aspect of sustainability is important to protect and maintain the planet and societies. Accordingly, the United Nations Department of Economic and Social Affairs (UNDESA) is working towards significant capacity development studies to provide a shared blueprint for peace and prosperity for people and the planet and propose 17 'Sustainable Development Goals (SDGs) (2019). Their mission statement is being a blueprint to achieve a more sustainable future for all people and the world by 2030 and they call on everybody to work actively towards these 17 goals with science, technology, cooperation, and development activities in a global partnership. Accordingly, World Design Organization (n.d.) stated that at the core of the design discipline is always finding a better way and improving the quality of life, and can therefore provide a fresh and innovative perspective on the development agenda. Moreover, they declared that they would advocate, promote and share knowledge of design-driven innovation that addresses the UN SDGs. In addition, according to Manzini (2010) "The only sustainable way to get out of the current worldwide financial and ecological crisis is to promote new economic models, new production systems, and new ideas of well-being" (p.8). In this context, it is possible to say that designers, who generate experiences and routines through the products, systems, or services they design have the power to positively or negatively direct and influence people's lifestyles and behaviours, and have serious responsibilities in taking steps against global crises. On the other hand, when considering sustainability and sustainable development, it would be a promising issue to know and learn the past and the traditional knowledge to use, empower, and promote it for a sustainable future. Accordingly, UNDESA stated that local peoples' traditional knowledge could offer valuable inspiration and solutions for challenges that trying to be resolved through the SDGs (2019). From these complementary perspectives, the main purpose of this study is to use traditional knowledge, which includes many sustainable habits and methods, with the intention of contributing to environmental sustainability and sustainable development by design knowledge and a social innovation approach. Then from this basis, we conduct a case study to experiment with this proposed link between traditional knowledge and sustainable development in a local district in south-eastern Turkey, and propose ideas to empower and promote traditional local labour and products. The main motivation and research question of this study framed as "How do designers or design researchers propose solutions or tools for a sustainable future by creating an intended link between traditional knowledge and sustainability?" To create this link, the methodology of this research framed as;

- 1 The literature review about the traditional knowledge and social innovation approach the from designer's perspective
- 2 Research and observations about traditional habits/methods that can affect/contribute to sustainable development in a local district
- 3 Development ideas proposal based on the social innovation literature and authors' design expertise for local and traditional values.

Background of the research

With the motivation of using traditional knowledge/methods as a source for social innovation and a sustainable future, empowering local and traditional values by social innovation approach and design knowledge, the background contains a literature review about the key concepts of the study. These concepts are the social innovation approach and traditional knowledge to learn the potential contribution of the social innovation approach for sustainability and sustainable development as a tool for designers, to learn the role of traditional approaches, and to create the basis for proposals.

Social Innovation Approach

Throughout history, innovation has helped societies overcome local and global challenges, and therefore, social innovation, which is an approach that responds to different layers of innovation, is very important to overcome environmental problems (Vasconcellos Oliveira, 2021). For tackling today's social and ecological circumstances, the social innovation approach seen as a driving force to ensure sustainable development and foster effective and inclusive growth (Castro-Arce and Vanclay, 2020). To create or propose new ideas of well-being, Manzini (2006) emphasized the importance of social innovation and he defines it as the change of habits of individuals or communities to solve existing problems in social, societal, or ecological issues, and an attempt to create new and sustainable opportunities. Relatively, he defines design for social innovation as a co-design process that includes a mix of different components that designers can offer such as original ideas and visions, design toolkit and creativity, and aims for social change (Manzini, 2015). Accordingly, Adams and Hess (2011) define social innovation as "innovative social action that can create social value beyond the capability of existing systems" (p.1). Similarly, according to Young (2011), it is a new instrument that improves individuals' well-being. Phills et al. (2008) define social innovation as a new proposal that affects the whole society rather than individuals for contemporary crises/situations, which is more effective, sustainable, or fair than existing solutions. They also state that social innovation can be a product, production process, technology, principle, idea, social movement, intervention, or a combination of all these notions. Generally, social innovation can be defined as new and functional conceptions to tackle social necessities (Mulgan et al., 2007).

Social innovation mobilizes social resources in terms of creativity, skills, knowledge, and entrepreneurship and, therefore can be a strong promoter of change and sustainable ways of living and production (Manzini et al., 2010). Thus, the social innovation approach expresses the potential to improve social outcomes and create value for people, places, and organizations, and focuses specifically on ideas aimed at promoting positive transformation for society (BEPA, 2011). Therefore, it is possible to say that there is a consensus on the idea that social innovation involves ideas that are constructed with the intention of finding solutions to current social problems or future objectives (Fifka & Idowu, 2013). To generate these actions for

creating value and strategies, Manzini's (2010) SLOC (Small, Local, Open, Connected) scenario could be a powerful actor for triggering, catalysing, and orienting a variety of social actors, innovative processes, and design activities. While considering sustainability issues and traditional knowledge as a source for sustainable development, there is a need for a bindery approach to reach SDGs and effective social innovation attempts. Manzini (2010) proposes that the SLOC approach is a useful guideline for social innovation projects that aim to focus on the local and small scale, as it directs the research to sustainable solution proposals. He mentioned that the ideas created with the SLOC approach should be understandable when taken individually and should cover a broad vision of how society can be when considered as a whole. He emphasized that for these SLOC proposals to be viable, small-scale solutions and locality should be considered within the global network framework, where the local and the small are both open and connected. He also highlights that building these connected systems is the only way to transition to knowledge-based, sustainable societies. Through this approach, the output is a kind of cosmopolitan localism (Sachs, 1998; Manzini & Vugliano, 2000; Manzini & Jegou, 2003). In sum, using a social innovation approach for understanding and empowering the traditional and local values for sustainable futures could be a significant design activity for today's world.

Using Traditional Knowledge in Social Innovation

The definition of traditional knowledge is the accumulated knowhow created by local people through a deep understanding of the experiences, behaviours, and environment related to the community in a specific culture (Warren & Rajasekaran, 1993; Al-Roubaie, 2010; Orlovic Lovren, 2019) and "It is the knowledge of local groups with a unique culture, history, and social relations" (Orlovic Lovren, 2019, p.1). According to the UN (2019), the importance of this knowledge, arouse interest in recent years for achieving the Sustainable Development Goals (SDGs). Clarke (1990) stated that this traditional knowledge is a valuable experience set of past sustainable, efficient traditions/habits that can serve to help reduce environmental damage in today's world where modern technologies, rapidly increasing population, and industrial advancement. He also mentioned that many traditional techniques and aspects of traditional knowledge can and should be used in conservation and resource management today because it has so much to contribute to the current age, and the use of traditional knowledge can facilitate community participation in environmental plans and purposes. While there are those who think that traditional is static or only valuable for the past, there is a broad consensus that traditional and local knowledge is both cumulative and dynamic, based on the experience of previous generations, and able to adapt to current technological and socioeconomic changes of the world (Laird, 2002). On the other hand, understanding the nature and power of traditional and local people's knowledge for using it in the context of sustainability requires an effort to learn about their social and cultural contexts and lifestyles (Orlovic Lovren, 2019). In addition, the maintenance and transmission of this tradi-

tional knowledge, which aims to be understood and used in the context of sustainability, depends on the transfers, interpretations, and meanings conveyed through culture-specific communication forms (UN, 2021). All these aspects of traditional knowledge play a prominent role in facilitating and transforming activities against climate change (UN President of the 73rd session of the General Assembly, 2018). Based on these discourses, the use of traditional knowledge that can contribute to sustainability and sustainable development can be a valuable input in social innovation studies aiming at social welfare.

An Intervention: Proposals for Empowering Local and Traditional Values

Based on the motivations and the literature, to experience the aim of developing and disseminating traditional and sustainable knowledge with a social innovation perspective and design expertise, a case study was conducted in the Arsuz district of Hatay, located in south-eastern Turkey.

Why this district?

Arsuz is a small, traditional but also modern, cosmopolitan border town, which has many traditional, local, and sustainable values, habits, rituals, and sources. There are different motivations and reasons for carrying out the study there. The most important of these are the region's traditional, local, and sustainable resources and habits, which are affected and formed by the different cultures. Another motivation is that Arsuz is the hometown of one of the research authors, which facilitates access to local resources, knowledge, and networks. According to Manzini (2010), there is no promise of designing and implementing sustainable solutions without starting from the local and its communities, making these localities open, and connected in the context of contemporary transformations. From this perspective, it has been tried to create proposals for Arsuz's small and local traditional knowledge to make it open and connected with design knowledge.

Details of the case

In the field research phase, the authors requested and get support from the local municipality and a Social Solidarity and Assistance Association to reach direct information about local rituals and knowledge. The association is a voluntary-based community in Arsuz, established in 2019 and it supported by the local municipality of Arsuz. The community generally tries to conduct projects for social well-being and local labour empowerment. After meeting and examining the association, the authors specifically focused on one project of the m, which is the District Bazaar by Women Labour (Kadın Eli Semt Pazarı in Turkish). This project aims to enhance the participation of women in the local economy and to empower local

women labour by providing an area for them to sell their homemade products. The bazaar is set up in two different spots in the district, with different days per week with the support of the association and the municipality. Different local products sold in these bazaars like soaps, baskets, jams, etc. in line with women's own facilities and knowledge. The research continued with two interrelated phases, starting with these decisions and preliminary steps.

In the first phase of the project, the District Bazaar by Women Labour project examined in detail with the SLOC approach and improvement ideas proposed for the project based on the SLOC approach and design knowledge. The aim of this phase is to understand the motivations of both association and local women participants, and then propose improvement ideas for the overall system. Interviews and observations were conducted to examine and analyse this specific project and to understand the motivations, limitations, and potential of women's traditional knowledge. According to these interviews and observations, some examinations classified the association and bazaar as a research output of the first phase. In this direction, there was a need for powerful and controlled communication with the association and participants, specialized cooperation for labour, rediscovery of the existing products and production process, new partners or platforms to develop the products and systems and to be open, rediscovery of individual and social capabilities and finally, need for standardization, branding, and marketing of the products.

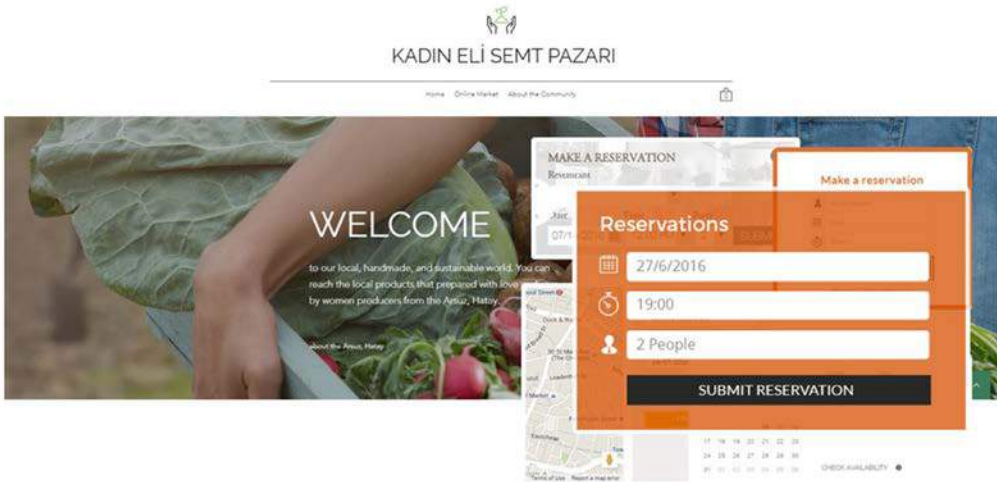


According to the examinations and outputs of the first phase, three main improvements were proposed to enhance this specific project and the local values in the second phase of the project.

In the first stage, it was observed that the women selling in the bazaar communicated with the association through weak communication channels. For example, methods such as scattered communication over Facebook or Instagram pages, uncontrolled and unplanned telephone conversations, and/or face-to-face meetings were used. So, the first proposal was framed as a 'communication platform between woman participants and association' to create a membership and reservation platform to increase communication between women producers and the association, both to gather new participants to the system and further communications between them. Because controlled communication is important for powerful smallness while considering the SLOC approach. In this digital platform Fig. 2, the producer is able to determine a sales area in the

Fig. 1 (Avci, Cinar & Kaya, 2022). Examination and proposal phase of the District Bazaar by Women Labour (Kadın Eli Semt Pazarı in Turkish) case study. The framework of the first phase of the study.

market weekly after becoming a member. In this platform, women producers should be a member, and then make a weekly reservation while choosing a location. After their attendance request is approved, they can get the standardization packaging for their products. Another sub-alternative to this proposal is a physical solution for the membership through some registration spots for women that could not access the internet or digital tools.



In the first stage, it was observed that some of the products sold in the bazaar are produced directly by women, but many of the products need additional resources, ingredients, or parts. In the existing process, there is an unknown and uncontrollable relationship between women producers and suppliers of additional resources. This situation creates an unknown background for products. To prevent this, to evaluate and associate local resources and labor in a more controlled way, the second proposal framed as a 'new ecosystem for symbiotic production process' to empower and transform the local sources into a networked community. This idea proposed expanding the scale of the women's community and creating a cooperative from their capacities. Through this cooperative and the municipality's support, a farming or production area will be generated in the long term to provide specified resources to women producers. In these farming and production spaces, workshops or trainings could be conducted for developing products or production processes, or adding value to these local products by design knowledge. Through this proposed framework Fig. 3, local producers can create standardized, reliable, sustainable, and trusted products with concrete backgrounds and stories. In the beginning, the cooperative may focus on specific local, traditional, and sustainable products such as Algar soap, olive and olive oil, hummus, etc. to start as a trial. From the SLOC approach, this proposal is important for being local, open, and connected.

Fig. 2 (Avci, Cinar & Kaya, 2021). Prototype for the communication platform of District Bazaar by Women Labour (Kadın Eli Semt Pazarı in Turkish) website. Communication platform proposal between woman participants and association. Credits: The platform is not online.



Fig. 3 (Avci, Cinar & Kaya, 2022). Ecosystem proposal phase of the District Bazaar by Women Labour (Kadın Eli Semt Pazarı in Turkish) case study. The framework of the proposed ecosystem.

In the first stage and as the general motivation of the study, it was observed that some local, traditional and sustainable methods or habits are only accessible to certain audiences. In order to change this situation and to support a sustainable future both environmentally and in terms of sustainable development, traditional and sustainable products need to reach the wider masses. With this motivation, the third proposal is framed as an 'online selling platform for local products' Fig. 4 to make sustainable traditional products small, local, open, and connected. This platform aims to reach the local and global markets with local and traditional products, while stating their traditional details, sustainable production processes, general specifications, product stories, producer information, certification details, etc. This online platform is conceived as an inclusive platform that can be related to the two previous proposals or changed according to the needs of the products to be promoted worldwide.

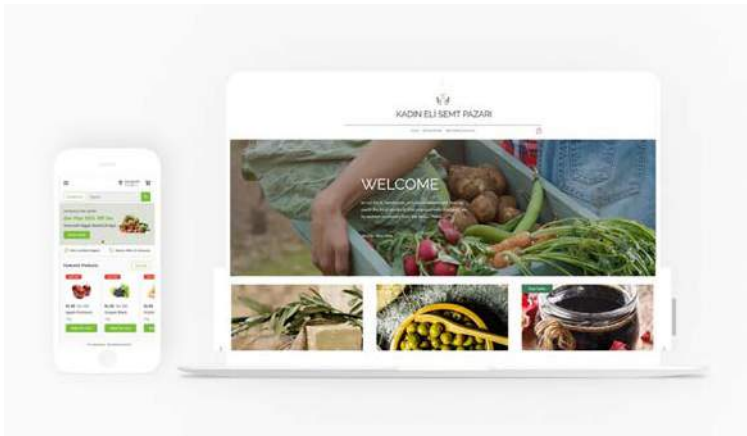


Fig. 4 (Avci, Cinar & Kaya, 2021). Prototype for the online selling platform of District Bazaar by Women Labour (Kadın Eli Semt Pazarı in Turkish) website. Online selling platform proposal for the products of the Bazaar. Credits: The platform is not online.

Conclusion

In this study, local and traditional knowledge in a local district in Turkey was examined through a specific local social assistance and solidarity association, and some notions were chosen from there to develop and main proposals generated according to these notions. These proposals are based on the social innovation literature and authors' design expertise and they involve different approaches such as an ecosystem that promotes co-creation, raising local labour and employment, symbiotic production processes, and digital marketing platforms for local products. In conclusion; according to the main literature and case study in the local area, using a social innovation approach and traditional knowledge as a source for sustainable development can be a valuable actor to reach social well-being. These kinds of attempts are also important to propose applicable ideas in different locations on a global scale to empower local knowledge or labour, add value to local resources and local products, and promote them internationally by design expertise in a sustainable way. We can say that feeding from social innovation literature and developing social dialogue, improving local products and adding value to them from a different perspective, and trying to empower women's labour has been the most important role and contribution as design researchers in this case.

Further Studies

This study was conducted as described and presented to the local government in 2021. Now, they are trying to realize these proposals by taking this sample as a source for a sustainable future as proposed in the study. As a further phase of the project, we will be planning to focus on specific local and traditional products from the district and try to add value by promoting local products through design knowledge. We will study these chosen products' details, rituals, and capacities. After that, we can generate ideas for adding value to local products, improving the product or production process, branding, proposing marketing strategies, developing partnerships or collaborations, creating alternative sales channels, etc. Besides, a separate follow-up study could be conducted by focusing on measuring and evaluating the role, impact, and contribution of designers or design researchers in such social innovation acts.

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Cultural Factories: Conversion of Industrial Areas into Cultural Hubs

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Abstract

The need to restore the former industrial factories so as not to leave the buildings and the neighborhood in a state of neglect has attracted scholarly and popular attention. The following contribution aims to highlight how designers can contribute to the repurposing of buildings by paying attention to the end user and planning new experiences and activities by reading case studies of industrial conversion of production sites into cultural hubs. The company's history, intrinsically linked to the territory, and its products, are the protagonists of the reconversion so as not to forget the past local productive culture demonstrating how it is possible to generate new and different economies from before. The case studies tell the story of the industrial conversion of companies and mines in urban and decentralized areas to get a representative look at the Italian and European territories.

Keywords

Industrial conversion
Cultural heritage
Production sites
Territory and culture
Cultural services

Introduction and research context – former industrial factories

In the last decades, there has been a surge of interest in the effects of disused factories or industrial centers, beginning with industrial expansion after World War II that created massive areas of industrial archaeology over the years. Nowadays, these places, abandoned and a source of urban decay, negatively impact people who live nearby; the buildings undergo a slow and progressive deterioration that consequently makes the entire neighborhood unattractive, unsafe, and unpopulated. The existing body of research suggests that they can instead be, and have already been, enhanced through several initiatives. Indeed, those places are a significant part of the urban heritage (Sposito, 2012) and a resource to exploit for their embedded values and sunk costs. It has previously been observed that the topic “is not only scientifically but also an economic and heritage issue for regions which are now severely affected by the industrial restructuring process” (Mercuri et al., 2014). The reconversion process (Schwartz, 1992) is a phenomenon that affects various fields, from architecture, the most well-known association in the literature, to design, in all its facets, as the contribution will later highlight. The reconversion should consider several aspects of the former production site, such as the architectural forms, the building materials, and the company’s history and know-how that shaped the production context to implement context-consistent change (Lerma, et al., 2018). Abandoned industrial centers, for which redevelopment, restructuring and functional adaptation are urgently needed, can offer the development of engaging services focused on the territory’s characteristics. The causes of the abandonment of these areas are multiple and non-simplifying. In Italy, where the case study research started, the offshoring effect has caused the reallocation of labor abroad, where production and labor costs over the years were lowered. As a result, production was gradually relocated to foreign countries. The abandonment of critical industrial areas, often also located in urban centers, is one of the consequences. Disused industrial areas affected 3% of the territory in urban and suburban areas, and 70% of abandoned industries are located in decentralized areas (ISTAT and Associazione Nazionale dei Comuni Italiani, 2012). In this research, the term “industrial areas” includes not only factories but also extraction sites; as far as following the exhaustion of deposits, quarries and extraction sites are often abandoned. There are 14,000 abandoned quarries in Italy, involving one-fifth of Italian municipalities (Legambiente, 2021).

Cultural services are the fil rouge linking the whole research through different geographical locations, material cultures and manufacturing production. This paper is the first analysis that aims to spotlight how specific interventions in places that have apparently exhausted their value, focused on cultural-driven enhancement, not the architectural and urban ones, can create new opportunities for the local population and give new visibility to the area. The discipline of Design will guide the mentioned interventions in many facets, such as those indicated by ADI - Associazione per il Disegno Industriale in Italy: communication design, exhibit design, service design, and social design.

The paper aims to investigate the following research questions:

- What role can the discipline of Design play in the framework of industrial conversion of disused production sites?
- What elements and opportunities should the designer seize to design an industrial conversion into cultural hubs?

The focus on decentralized areas is essential, where redevelopment is possible and concrete thanks to cultural-led interventions involving the local population, attracting outsiders, and engaging also “local, regional and national authorities and relevant stakeholders of the regional and national cultural system” (Dal Palù et al., 2018).

The following paper will cite four case studies of culture-led industrial conversions, witnesses of an efficient narration of historical production culture, in Italy and Germany, countries with significant productive economic development in urban and decentralized areas to find strengths to exploit.

There is literature (Kirshenblatt-Gimblett, 2004; Trocchianesi, 2014; Bozzola & De Giorgi, 2017; Parente et. al., 2017) on a broad debate dedicated to the relations between design and territory and the role of designers in creating new dynamics.

Methodology

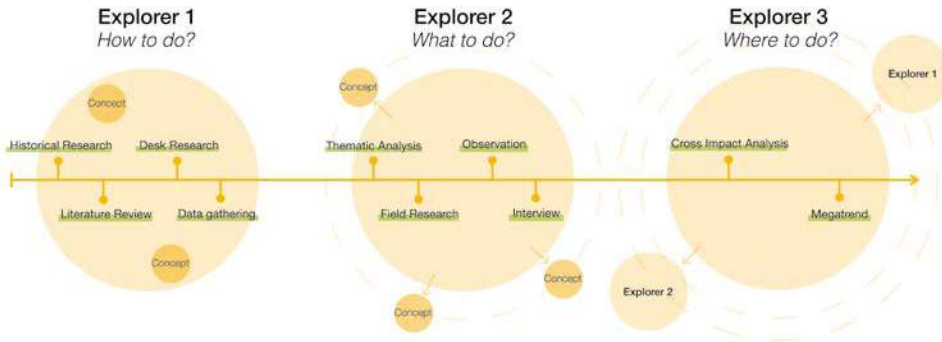
The research described here is a portion of the author’s doctoral path regarding tools and methodology to accompany companies to a design-driven industrial conversion. Section 4 proposes parallels of industrial conversion in developed and decentralized areas through selected case studies (Yin, 2017). The research involved the shape of a database of approximately 100 case studies of industrial conversion, it is divided into sectors: 60 cases of industrial conversion of manufacturing companies, 9 cases of wartime industrial conversion, 20 case studies of companies that temporarily reconverted production to produce essential goods during the COVID-19 pandemic. Finally, 10 case studies exemplify the opportunities that an abandoned production site, significant for the cultural heritage, can offer to transform itself into a cultural hub. The database contains useful information to understand the strategic levers that enabled the reconversion: production sector, manufacturing processes, assets, causes of the crisis, strategy of valorization. The research aims to analyze state of the art to understand the strategic choices made and to identify guidelines indicating new directions of diversification based on the available assets to transform abandoned factories into cultural hubs.

To address this scope, the research adopts the exploring design methodology path (Germak & De Giorgi, 2008), which can define new products and innovative services for the future, integrated with quantitative, qualitative, and mixed methods selected and used for the doctoral research. This methodological approach, framed from the Politecnico di Torino, matches requirements and performances, and is organized in three macro levels:

- Concept design, that answers to the question: “How to do?” (starting from fixed typologies and functions)
- Scenario design, that answers to the question: “What to do?” (starting from fixed materials and technologies)
- Exploring design, that answers to the question: “Where to do?” (starting from a spread ambit to investigate).

Therefore, adopting the exploring design path at the third level, it is possible to scope new meanings and functions for abandoned factories, starting from the analysis of the scenario that is state of the art: the territory, the local productive culture, buildings, infrastructures...

This collection of information and data is the starting point to explore new possibilities for redevelopment of the site, respecting and enhancing what was there before.

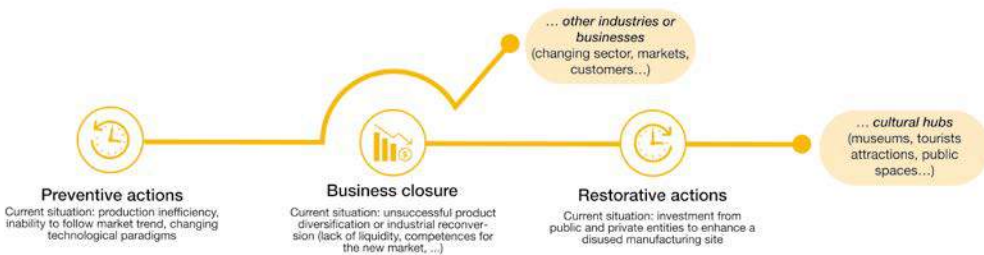


Industrial conversion and adaptive reuse for Creative Industries

Industrial conversion can generally be understood as replacing heavy industry with other industries or businesses or repurposing spaces for commitments other than the previous production. The first acts in a preventive form, and the second after the crisis has already occurred. Indeed, the first case is expected for bankrupt or failing factories or atypical and extraordinary adverse events (such as wars and the recent COVID-19 pandemic). The other direction has a variety of pathways to choose from, for example, to convert these places into cultural hubs: museums, tourist attractions, and public spaces. In Architecture, this is defined as adaptive reuse, and the literature on this subject is extensive, mainly related to cultural heritage (Plevoets & Van Cleempoel, 2011; Foster & Saleh, 2021; Li, et al., 2021). This second line of action is an offshoot of doctoral research and the focus of this paper, close to the themes of Creative Industries (BOP Consulting & Korean Research Institute on Human Settlement, 2020) or the so-called Creative Economy, which, according to Howkins (2007) “includes all the sectors whose goods and services are based on intellectual property” (p. 86). The most recent references appear as Orange Economy (Buitrago Restrepo & Duque Márquez, 2013), as orange has often been associated with culture, creativity and identity. So, in these conversions to cultural hubs, which include goods and services traditionally associated with public cultural policies and creative services, the focus shifts from producing goods to providing services for the local community, capable of attracting tourists.

Fig. 1 Exploring Design methodology. © Germak & De Giorgi, 2008. Authors' graphic adaptation of the original (in yellow the Exploring Design methodology, in green authors' doctoral selected methods).

Converting former heavy industry by...



Case studies

The following case studies represent a small but significant selection of good practices for an efficient industrial conversion of abandoned industries and mines into cultural hubs related to industrial design. They are examples of beneficial change for the territory because many abandoned sites seriously negatively impact the environment and people living nearby. These four case studies are particularly significant for the call of the related conference for their economic, social, cultural, and environmental impacts.

The Zeche Zollverein Coal Mine Industrial Complex

The first case study regards the Ruhr metropolitan region in Germany. It developed with the industrial revolution and became one of Europe's most densely populated regions and a stronghold of heavy industry, coal, and steel mining. After the crisis in the 1960s, reconversion was neither quick nor easy as it had the highest percentage of disused industrial and mining land in East Germany. The Zeche Zollverein Coal Mine Industrial Complex in Essen was one of the world's largest mines in size and production, which was definitively abandoned in 1986. The area has invested in research, education, alternative economies, and culture with public and private investments. Not only that: the industrial heritage has been saved and reconverted, becoming a proper open-air museum. The former boiler house was converted in 1995 by the architect Norman Foster for this new purpose. Today, this vast complex, a declared UNESCO World Heritage Site in 2001, can be visited to retrace the cycles of coal mining and learn about the work in the mines. However, the Zollverein is an avant-garde cultural center: it houses the Red Dot Museum, the world's largest design museum that, with more than 4,000 square meters of presentation space, hosts the world's largest exhibition of contemporary design.

Fig. 2
Preventive or restorative action of industrial conversion. © Graphic by authors.



Fig. 3
The "Slim in Motion"
luminaire by Licht Cube in
the old structure. © Red
Dot Design Museum

The Lingotto plant

The Lingotto, in Turin, Italy, is an area of buildings that was once one of the leading production plants of the FIAT automobile factory, later converted to a sizeable multi-purpose center. It is now home to numerous stores, restaurants, a cinema and an exhibition center, the venue for significant cultural events related to the publishing world each year. Of particular interest is the recent opening of Casa 500 and Pista 500. The first one is a museum designed by LAB71 Architetti studio, dedicated to the famous and iconic FIAT 500, a world-recognized symbol of Italian automotive design, a pop icon, and a symbol of empowerment. Pista 500 is Europe's most extensive roof garden, with 40,000 native plants, and a track for electric cars, bicycles, and scooters. The same track where, years ago, cars built in the Lingotto factory below used to be tested. Pista 500 was realized by the Camerana&Partners studio, with the collaboration of the Turin architect Cristiana Ruspa, who specializes in landscape, gardens, and botanical gardens. When it was a factory, the entire assembly line developed across the height of the building until the car testing on the roof. This concept provides the city with a new space to relax and reconnect with nature in an increasingly urban way.



Fig. 4
Pista 500 at Lingotto. ©
Marco Schiavone_courtesy
Benedetto Camerana
Studio

The Val Germanasca talc mine

As affirmed before, conversions do not only concern industrial plants but also places such as mines, places that inevitably created an impact on the area and that can, once the quarry is exhausted, be enhanced and tell the story of their productive culture. In the Pine-rollo valleys, in the Piedmont region, in Italy, talc extraction began at the end of the 18th century. Talc mining represented for many years the only possibility of work for the inhabitants of Valle Germanasca. Today, the will is to remember that period and the sacrifices made for the area's development. Thus, the idea to tell the story of the mine through a guided tour that show the "gold of these valleys" was born in 1995. In addition, it is possible to access the Ecomuseo delle miniere e della Val Germanasca (Ecomuseum of Mines and Germanasca Valley). It is a modern cultural proposal organized to describe the miner's life to the public. The Eco Museum thus expresses the desire of the local people to bear witness to their identity by promoting knowledge of the territory's past through designed exhibit projects. Its dual muse is the silver mining museum in Argentière la Bessée, a decentralized mountain area of Savoie in France; that is an ancient silver mine whose modern mining began in 1785 until 1908 when the deposit was considered exhausted; since 1992, the mine has been an eco-museum.



Fig. 5
The Ecomuseo delle
miniere e della Val Germa-
nasca. © Photo by authors.

The European Network of Coal Mining Museums

The second case study concerns The European Network of Coal Mining Museums, which includes seven museums located in Europe (Centre Historique Minier du Nord Pas-de-Calais in Lewarde, France; Bois du Cazier in Marcinelle, Belgium; National Coal Mining Museum for England in Wakefield, England; Deutsches Bergbau Museum of Bochum, Germany; Muzeum Gornictwa Weglowego Kopalnja Guido of Zabrze, Poland; Museo de la Minería y de la Industria de Asturias, Mina San Vicente, Spain; and finally Centro Italiano della Cultura del Carbone, Carbonia, Italy). The network is synergistic in four different activities: through the exchange in the field of scientific research to promote and enhance the industrial heritage through studies in diverse research fields; exchange of professional practices for museum management and to improve visitor services; exchange of cultural productions (such as exhibitions, publications) to increase the number of exhibition topics by making them always up-to-date and exciting. Finally, a collaboration from the perspective of communication and marketing is a synthesis of the previous three activities. These redevelopments of mines in decentralized areas, once the focus of economic activity, are essential because they are considered museums of places and territory, expressions of a past.



Fig. 6
Exterior view Deutsches
Bergbau-Museum
Bochum. © Karlheinz
Jardner

Results and discussion

There may be a perceived misconception of former industrial sites being not economically attractive or competitive for a region, and there is not a theoretical framework to understand their attractive features (Tu, 2020). Designers can find several opportunities to exploit post-industrial areas through selected design methods. As the case studies show, through the enhancement of historical and cultural values, the exploitation of sunk costs, the possibility of making private places accessible, the evidence of the past and the material culture become protagonists of the conversion project. Regenerating a former industrial area means revitalizing an entire area, enriching the city in which it is located and giving new value

to the territory offering new economies that are more widespread than before (with a more efficient accommodation and transportation system and increased trade). Abandoned industrial areas can be transformed according to local, territorial, national strategies, through, for example, by EU funding programmes (Multiannual Financial Framework, NextGenerationEU ...). The solutions can be different and can span different scales of the project, from product to service to communication; for example, strategies that allow a high degree of flexibility with a temporary use or attractive alternatives by creating museums and cultural spaces. While respect for the place's history and inhabitants is essential, exporting and making this history known to locals and to the outside is equally vital through tourism, as in several projects that connect cultural heritage with places and social contexts. Indeed, tourism could be one of the primary income sources for those reconverted cultural hubs as an important player in international economic development.

The figures of designers play a crucial role in this context by making essential contributions: designing inclusive services, planning tourist and cultural initiatives focusing on the past and history of the territory and the company with its resources in a resilience way (Fassi & Sedin, 2017). For the next steps of the research, the will is to classify these case studies to find insights or intuitions from individual case studies, for example, how the case studies organized site spaces, uses, related services; bring the insights together to find guidelines for companies in crisis that can convert unused spaces into cultural hubs.

Conclusion

The territories and the places described are examples that present strategies of growth and regeneration to develop creative activities focused on the environment and the productive, social, and cultural context.

An important theme that emerged is that the conversion implies significant changes both on-site and in the surrounding territory. Therefore, the dense network generated among the stakeholders can provide territorial development and create a favorable local economic environment. This contribution discloses the tangible and intangible heritage of immense value through the conversion of dis-use sites and design-oriented initiatives that could be inserted into a more comprehensive strategy of valorization of the cultural heritage. These reconversions offer the area new economies that are more widespread than before (the accommodation system, transport, trade). The finding of this study suggests that the discipline of Design can accompany industrial conversion processes in decentralized areas as a tool for innovation, capable of exploiting those places that once produced goods and now produce inclusive services with high added value. The application of design in this type of conversion, halfway between a service and a policy, might seem a leap. Instead, many typical designer's skills are exploited: "making seemingly intangible things tangible to the teams working on them. A service or system, for instance, is made up of a series of "touchpoints" [...]. A map of these can be sketched, just as an object can" (Design Council, 2013, p. 7). The designer's role has changed in the last decade; new methodologies and tools applicable to service development and policymaking are being transformed (Design Council 2013; 2018).

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The importance and originality of this study are that it explores industrial conversions through the lenses of culture dissemination in decentralized areas. The case studies mentioned exemplify opportunities for rebirth by exploiting available resources. These conversions are part of the Orange Economy as an activity that has enabled ideas to be transformed into cultural goods and services, thus forming the economic sector of the creative industries (Buitrago Restrepo & Duque Márquez, 2013). The topic appears to be of increasing interest to the European community and beyond. For instance, “European routes of Industrial heritage” is an itinerary containing 1,000 industrial sites in 43 European countries that creates a massive network of different realities to promote the industrial heritage.

The discussion on this topic is open to research institutes, researchers in Design, other disciplines and experts dealing with territorial development and enhancing of productive capital with whom to dialogue in research development.

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Bahrain Knowledge Bay. Using Design Thinking to Establish an Infrastructure Towards Knowledge Economy

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Abstract

Design Thinking is a human centered methodology used to develop innovative solutions for complex problems, and it has been recognized as a flexible, collaborative platform to help solve intricate social and economic difficulties. This research paper addresses the possibilities of using design thinking as a methodology and a tool to help establish an infrastructure towards a national knowledge economy. The center stage of this endeavor is the country of Bahrain being ready to embrace such a concept to be the backbone of the country's growth strategy. Hence the Bahrain Knowledge Bay [BKB] was established as a human centered community system designed to support both individuals and companies, not only to share and/or benefit from the provided knowledge, but also to strategize on how to fill the gaps between what is existing and what is needed in the areas of Design, Entrepreneurship, Vocational Education, and R&D. BKB aims to spearhead the way towards new development of a forward-thinking hub which would be both, open to international ideas and simultaneously deeply rooted in its surroundings.

Keywords

Design thinking
Knowledge economy
Human centered
Community systems
Process strategies

Introduction

Design Thinking [DT] is a user-centered methodology using multi-disciplinary teams (Thoring et al., 2014) used to develop innovative solutions to wicked problems (Rittel, 1972; Buchanan, 1992). It was first described as a collaborative process, and later as a human-centered approach to innovation (Brown, 2008). Because of its ability to push creativity and innovation further, DT has been endorsed as a flexible collaborative platform to help solve social and economic problems (Brown, 2009).

According to Ian Brinkley (2006), the most important attribute of a Knowledge Economy [KE] is that knowledge is the ultimate renewable economic format, given the fact that the stock of knowledge is not depleted by use, rather its value to any economic system is multiplied by being shared with others (Brinkley, 2006). It is worth noting that 'information economy' and 'knowledge economy' are often used interchangeably. Although either term still lacks a unified academic definition (Zins, 2007), there is a general understanding of what knowledge economy refers to (Rowley, 2007). Based on its intellectual capital, KE embodies a large and significant share of economic activities, where a substantial component of its value consists of intangible assets such as workers' knowledge and/or intellectual properties (Hayes, 2021).

This research paper addresses the possibilities of using Design Thinking as the main tool to establish an infrastructure towards a national Knowledge Economy

The addressed context is the Kingdom of Bahrain which, in its Economic Vision 2030 document, clearly states its aim "to establish a platform for advancing innovations to market readiness, which will help Bahrain tap into the global knowledge economy" (Bahrain 2030 Vision, 2008).

The case study used in this article is the Bahrain Knowledge Bay [BKB] which was established as a human-centered community system designed to support individuals and companies. The idea behind it is not only to share and/or benefit from the provided knowledge, but also to strategize on how to fill gaps between what is existing and what is needed in the areas of Design, Entrepreneurship, Vocational Education, and Research and Development.

The expected research outcomes of this case study will be on two levels: the ecosystem level and the organizational level. With respect to the ecosystem, the research offers clarifications as to how DT can lead to more inclusive and sustainable solutions for economic development through collaborating with existing Bahraini governmental and institutional support systems. At the organizational level, the study puts forth notions as to how organizations can support the creation of a national innovative hub by applying the DT processes, and how these processes can set the example for others to follow in terms of agility, engagement, and responsiveness.

With a DT and KE literature review as a start, the context in which the project takes place comes next, followed by how BKB infrastructure is different from traditional systems of knowledge sharing. Then, the project concept and description are presented, followed by the proposed methodology of work, leading to the proposed contributions and outcomes.

Literature review

Design Thinking is a methodology used to develop innovative solutions to wicked problems (Rittel, 1972; Buchanan, 1992). It is a process utilized to generate user-centered innovative solutions through multi-disciplinary teams (Thoring et al., 2014). DT was originally introduced and shaped by the design consultancy IDEO (Kelley & Littman, 2001) and has become popular among business schools and R&D corporate departments to foster innovation and solve complex problems (Thoring et al., 2014). According to Plattner, Meinel, and Weinberg (2009), there are 3 main components that are at the core of design thinking: the process, multidisciplinary teams, and the flexible workspace. At the helm of these components is a specific design thinking culture that includes rituals and a specific mind-set (Plattner, Meinel, Weinberg, 2009). In 2009, Tim Brown—IDEO Chair—described design thinking as “the collaborative process by which the designer’s sensibilities and methods are employed to match people’s needs with what is technically feasible and a viable business strategy” (Brown, 2009). Later in 2018, Rikke Friis Dam and Teo Yu Siang described it as “a human-centred approach to innovation that draws from the designer’s toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success” (Dam, Siang, 2018). DT has grown beyond the mere aesthetics of what it is supposed to produce and has been applied to “business, engineering, technology, and more recently, education, because of its ability of advancing creativity and innovation by applying an empathetic, flexible and iterative approach” (Lor, 2017). And while DT is rooted in the design professionals’ tools and practices, it has expanded beyond this realm to strongly insinuate that everyone is a designer, and anyone can perform the process of design in his or her specific sector of work (Fayard, 2018). It is this consideration that gave DT the reference of being a strategic approach to problem solving, specifically when the problem itself is not considered as a given, but something that must be defined and redefined through the intensive exploration of adequate solutions (Fayard, 2018).

The concept of Knowledge Economy is based on several theories, including information theory (Machlup, 1962), post industrialism theories (Bell, 1973), and the views of Drucker, who popularized the terms “knowledge society” in 1969 (Drucker, 2006). On a larger scale, OECD defines KE as depending on the creation, transfer, and application of knowledge and information (OECD, 1996). Furthermore, KE encompasses other dimensions of endeavors and perspectives. For instance, it concentrates on the emergence of new science-based and information-rich businesses and their significance in social and economic transformation (Powell, Snellman, 2004). The significance of theoretical knowledge as a source of innovation is another major concept underlying the manifestation of KE (Bell, 1973) and its connection to data and information (Hippe, Fouquet, 2018). By transforming data into human capital, KE offers enormous prospects for economic growth and to becoming the foundation of future economic development. As per Rooney, “knowledge is people doing things, knowledge economies are people doing things with better outcomes for more people” (Rooney et al., 2012). The key takeaways of KE fall under four main pillars: first, a research-based

innovation manifested via different forms of intellectual property; second, the crossover between entrepreneurship, academia, and government-sponsored research; third, skilled combination of labor and education; and fourth, strong communication networks between institutional organizations that incentivize innovation (Hayes, 2021).

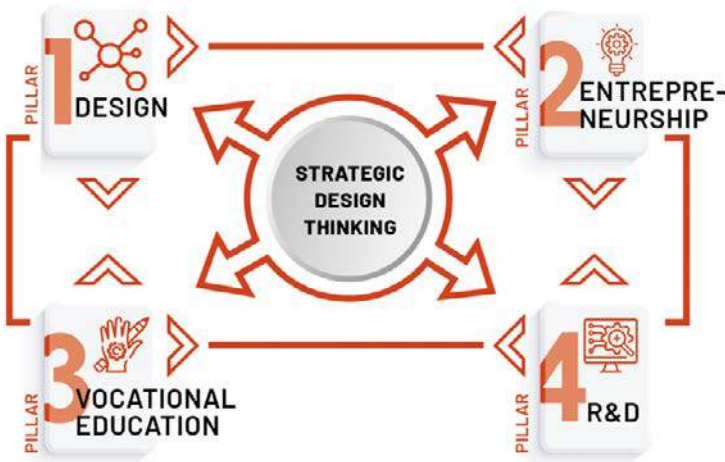
Context

Situated in the Arabian Gulf, the Kingdom of Bahrain is a country composed of several islands, both natural and manmade, rounding up to 33 in total (UNDP, nd). With a population of 1,650,000 (Britannica, nd), the Kingdom enjoys a strategic location in the Middle East (UNDP, nd), being the most important commercial crossroads for over 4000 years amongst its neighboring Arab countries (undp.org). Economically, the Kingdom enjoys a mix of state-owned and private enterprises depending largely on petroleum and natural gas refining in addition to an advanced banking sector (Britannica, nd). Bahrain is ranked as a Developing/Emerging high-income economy, with an estimated GDP of \$38,653 billion in 2019 (World Bank, nd). According to its 2030 Vision, the Kingdom is “aspiring to shift from an economy built on oil wealth to a productive, globally competitive economy, driven by a pioneering private sector, embracing the principles of sustainability, competitiveness, and fairness to ensure that Bahrainis secure a fulfilling life and reach their full potential” (Bahrain 2030 Vision, 2008).

Concept and Project Description

Bahrain Knowledge Bay uses strategic design thinking as the main tool to establish an infrastructure towards a national knowledge economy based on 4 pillars. Its focus on DT as a catalyst aims to facilitate communication between the pillars and offer a variety of specialized tools to be used by members of the local community, who in turn will become contributors and innovators who support BKB's ecosystem every step of the way. BKB is designed to build and support synergies in different programs that improve learning and boost design and cultural innovation. This vision draws similar notions to the creation of a Knowledge Zone [K-Zone] in Curaçao, which investigated the “framework for understanding the creative economy of Small Islands Developing States (SIDS) in the Caribbean and how change can be implemented in these settings” (Goede, Neuwirth, Louisa, 2012). Notwithstanding, BKB is not analogous to the K-Zone project that was based on a theoretical framework involving the creative class and how this innovative class can be attracted to a specific location to create synergies and momentums (Goede, Neuwirth, Louisa, 2012). Rather, BKB is designed on a pillar-based model Fig. 1 that can grow organically as required, with design thinking as the catalyst among these pillars, aiming to attract all passionate individuals who would like to develop their creative or innovative ideas and see them come to light.

Fig. 1
Halim Choueiry, 2021.
The Bahrain Knowledge
Bay structural working
model.



As a start, and following an in-depth needs research, BKB opted to launch with the most identified pillars, which are Design, Entrepreneurship, Vocational Education, and R&D. These pillars are inherently connected by the nature of their content and mirror those of the KE which naturally feed into each other. DT comes as the catalyst and facilitator among all pillars. It is the operational tool with the ability to address arising issues and complexities, while at the same time ensuring that all pillars have a common development language amongst them.

Pillar 1 • Design

The aim of the Design Pillar is to encourage interested and design-passionate individuals who would like to develop their design thinking skills to innovate, on both products and services, to align their learning with the strategic goals of BKB through cross disciplinary experimentations programs. This will be achieved through interacting with experienced designers and industry professionals where they will be fully exposed to the DT process and other related tools. This falls directly into paving the way for a KE growth when it comes to innovation-based research which later will be manifested through the different forms of intellectual properties (Hayes, 2021).

Pillar 2 • Entrepreneurship

The aim of this pillar is to grow capabilities by supporting innovative ideas for both individuals and companies, which will eventually lead to building benchmarking systems for Bahraini organizations' best practices and innovation leadership. This pillar also aims to support established organizations to shape institutional innovation capacities through educating, training, and applying research findings in the fields of innovation and entrepreneurship, which is also a direct feeder into KE since this pillar will be at the cross over between entrepreneurship, academia, and government-sponsored research (Hayes, 2021).

Pillar 3 • Vocational Education

This pillar is specifically designed to provide apprenticeship in its best format. Vocational education can take place at any scholastic level either in dedicated spaces or on job sites, where partakers will learn the theoretical, technical, and practical aspects of any trade from accredited knowledge providers and established professionals. This will also be another component of KE which clearly depends on skilled labor and a combined theoretical/technical education (Hayes, 2021).

Pillar 4 • Research and Development

As a start, and in light of the limited research and data, the aim of this pillar is to create a comprehensive database to identify potential growth areas, and diverse pathways, where significant interventions can be made to boost ideas forward. Further down the road, this pillar will also act as an R&D entity for innovation and scaling up to encourage new ideas for adjacent products as well as innovate on already existing ones. The R&D pillar will be serving all other pillars, and therefore will be a major contributor to laying the foundations of the future knowledge economy of the Kingdom.

Bkb Infrastructure Versus Traditional Systems of Knowledge Sharing

The uniqueness and significance of the BKB model lies in the fact that it is deeply rooted in the Bahraini culture and environment. In traditional systems of knowledge sharing, it is often the case that a standard knowledge sharing model with its tools, processes and structure is imported and imposed on an ecosystem, as is the case with several neighboring countries. The BKB proposed model employs a grassroot approach inspired from the local and national environment of Bahrain. It proposes a systematic methodology for the local habitants to identify and design their own tools, which are inspired from the social fabric of Bahrain and used to create and grow a knowledge culture that is by Bahrainis and for Bahrainis.

Proposed Methodology

This study adopts a case study qualitative methodology (Denzin & Lincoln, 2008) for two reasons. The first being the possibility to place the respondents' behaviors more accurately in their natural sociocultural context, and the second to enable this investigation to be more precise about the unique circumstances of both individuals and organizations when it comes to DT and KE. This approach offers the possibility to identify, describe and measure successful implementation of DT by identifying its critical success factors that are usually grouped in 4 categories: Strategy, Process, Competence and Culture (De Paula et al., 2019). Strategy will outline which practices can be employed when DT is being used for development. Culture

will measure the amount of collaboration and team diversity as community-building factors. Process of implementation will provide the necessary materials and needed environment for outcome visualization. And finally, Competence is directly related to team members' individual competencies and how this can be enhanced by using DT (De Paula et al., 2019).

Data collection methods will include individual and group interviews, observations, and documentation that are typically consistent with case studies (Mason, 2006). Considering the dual levels of impact of BKB at the organizational as well as ecosystem levels, data collection will have to consider both aspects. Where the ecosystem is concerned, the study will opt for a hands-on DT workshop, combined with direct observation, followed by group interviews, where answers will be collected and analyzed accordingly. For the organizational level, the study will opt for a series of one-on-one semi-structured interviews that help identify the areas of weaknesses in the organization at first, followed by a hands-on DT workshop, which deeply investigates a chosen weakness, followed by group interviews where answers will also be collected and analyzed accordingly.

Thus, this study will adopt a content analysis approach since it allows for the classification of the textual data quantitatively and methodically. This methodology entails examining the explicit content of data, such as the words, phrases, or concepts that are openly conveyed as well as their frequency, distribution, and trends of particular terms or topics (Ragab & Arisha, 2017).

Proposed Contributions and Outcomes

The study is expected to have academic contributions as well as practical outcomes. On the academic level, this article will offer significant insights on the contribution of DT in the establishment of a national knowledge economy. Such a contribution will open avenues for further investigation and research on the role of DT in various fields. On the practice level, the proposed contributions and outcomes encompass coordinated programs of activities for design, business, education, and the community. The contribution is twofold:

Ecosystem Level

The outcome of this study will allow BKB to strategically collaborate with the existing Bahraini governmental and institutional support systems such as the Bahrain Economic Development Board, Export Bahrain and Tatweer, by setting standards for the Bahraini design outcomes through the 'Designed in Bahrain' label Fig. 2.



Fig. 2
Halim Choueiry, 2021.
Designed in Bahrain identity label.

Organizational Level

The outcome of this study will allow BKB to set the example for others to follow in terms of agility, engagement, and responsiveness. BKB Pillars are designed in a manner to allow the addition of new pillars when identified as needed in the future—such as a tourism pillar for example—which is also part of the strategic alignment with the Bahraini government vision.

Conclusion

This study investigates the use of DT as the main tool to establish an infrastructure towards a national KE. Being a user-centric, iterative, and innovative approach, DT can be the critical catalyst to drive and create effective and impactful knowledge infrastructures that drive productivity, innovation, and collaboration in the KE. Notwithstanding, the project could potentially face obstacles in the development of knowledge infrastructures at the social and organizational level. Such obstacles include resistance to change due to lack of awareness and understanding, privacy and security concerns, technological barriers, and issues with user adoption and engagement. All these topics could potentially constitute avenues for further research and investigation.

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is a design thinker, educator, and process strategist. He is currently pursuing his Ph.D. investigating the role of strategic design thinking in establishing creative clusters. During his professional span, Halim occupied positions such as ICoD Vice President for 6 years, and several times Chairperson of Arts and Design Departments at different universities. Recently Halim relocated to Bahrain where he is undertaking a challenging endeavor which is to design and build a human centered community system using strategic design thinking as the main tool to simultaneously develop the growth process as well as adopt a common language among the various pillars across the Bahrain Knowledge Bay.

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Culture and Creativity as Assets for Inclusive Growth in Small and Remote Places: A Design-Led Process

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Abstract

This paper aims to highlight the design-led process in the research and the range of its application in contexts beyond the mainstream: the decentralized areas, defined as “small and remote places”. This is based on an ongoing action-research project called *SMOTIES - Creative works with small and remote places*, a four-year co-funded project by the Creative Europe Programme of the European Union. The ten partners involved in the project come from the cultural realm, including universities, design/art collectives, NGOs, and design associations. They aim at knowledge transfer, capacity building, and audience development in 10 small and remote areas in their own country. This paper refers to the first two years' activities focusing on the shared methodology and overall program.

Keywords

Cultural and creative sector
Design for social innovation
Design for sustainability
Community-centered design
Design futures

Introduction and approach

Started in 2020, the SMOTIES project Fig. 1 belongs to the *Human Cities* network involving, since 2006, design, art, and architecture universities, creative centres, and consultancies. Spanning all of Europe, *Human Cities* network acts as a platform of interdisciplinary exchange, examining and acting to improve the liveability of public spaces by using participatory design as an approach to supply systems of process and innovation.

Human Cities network has been funded throughout the years by the Creative Europe (Culture sub-programme) of the European Education and Culture Executive Agency (EACEA), consolidating its approach and creating opportunities in several European contexts to implement innovative experimentations, nurturing networks, building capacity with local stakeholders, and diffusing cultural values. Through SMOTIES, the *Human Cities* network shifts its focus from the urban context to small and remote European villages, districts, and sub-regions which are depopulated, relationally remote, and depositories of material and immaterial culture that risk being undervalued, not consolidated, not handed down, and hence lost (EY, 2021; OECD, 2018).

Based on the European quantitative criteria for Remote and Rural places (European Union Regional Policy, 2008; OECD, 2020b, 2020a), remote and rural places are those with a population density below 150 inhabitants per square kilometre, where 50% of the residents cannot reach the centre of a city of at least 50,000 inhabitants within 45 minutes. It means that in these areas there are geographical barriers and/or no good transportation links; therefore, the infrastructure system is underdeveloped in terms of sustainable mobility models able to support a better everyday life for all generations. Further, the access to essential services and amenities within walking distance is not inclusive regarding equality for all and affordability. These areas are often characterised by social divisions, or specific social groups struggling against economic issues due to local and global crises, such as the current financial one, the austerity measures, and the increase of the already present rural marginalization after the Covid-19 pandemic. These last factors have a significant role in making these areas isolated indeed. Nowadays, the leading causes of rural marginalization have not only to be ascribed to geography but to the "lack of access to resources [...] resulting from a lack of socioeconomic and political connections ('connectivity') and, hence, of relational 'remoteness' "(Bock, 2016, p. 556). As Castells (1996) and Sassen (2011) state, network society has enabled people to become part of global networks (Leadbeater, 2009), regardless of their physical proximity to dense infrastructures. Functional and relational factors play a fundamental role in active collaborative community systems and favour the growth of exchanges and connections (De Lange & De Waal, 2019; Manzini, 2021).

Accordingly, the Smoties project focuses on areas where proximity and social economy (i.e., proximity to a rewarding job market, proximity to research-intensive environments, the presence of community bonds) are weak or not valorised, generating spatial segregation.



Co-funded by the
Creative Europe Programme
of the European Union

1
<https://eit-culture-creativity.eu/about-us/>

Fig. 1
Human Cities *SMOTIES* –
*Creative work with small
and remote places* logo.
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Regarding scale and spatial features, SMOTIES small and remote places are territorial units composed of a network of places (both indoor and outdoor) located outside of major cities and hardly connected. They could refer to:

- villages/areas that may also be not far from major cities but difficult to reach (in terms of physical or relational connections)
- villages/areas with no relationships and interconnections with *Nodes of Creativity* (NoC), such as universities, research centres, outreach projects, innovative communities/networks
- villages/areas that still have not been involved in networks, creative bottom-up processes, and project-based experimentations.

Furthermore, they own an attractive material and immaterial culture that needs support from a NoC to be fostered through tangible experiences at the local level, to make relations possible among the community(ies), and to improve daily life. SMOTIES aims at identifying and activating possible trajectories for a local evolutionary pathway, leveraging existing minority excellence niches. This process is supported by participatory design and social innovation practices and is based upon the belief that culture-led regeneration and development strategies can transform places. The cultural and creative sectors not only offer social benefits (such as improved wellbeing and community cohesion) and economic benefits (through local taxation, job creation, innovation, and supply chains), but they also contribute to *place-making* by making cities and regions more desirable places to live and work, thereby promoting inward investment, inward labour flows, higher productivity, and increased tourism. A city or region's economic and social growth is the primary emphasis of culture-led regeneration and development programs, which encourage and facilitate cultural and creative activities. This approach is in line with the New European Bauhaus vision that “brings a cultural and creative dimension to the European Green Deal to enhance sustainable innovation, technology and economy” (European Commission, 2021, p. 3). This is also demonstrated by the recently started EIT (European Institute of Innovation & Technology) initiative EIT Culture and Creativity: “a Knowledge and Innovation Community designed to strengthen and transform Europe's Cultural and Creative Sectors and Industries (CCSI) by connecting creatives and organisations to Europe's largest innovation network”¹.

In this framework, SMOTIES focuses attention on networked, participated, and local creativity as a resource for a territorial profile (communication, life quality, image, reputation, innovation, clusters, etc.) for regional and destination development (Innerhofer et al., 2018, pp. 2–4). The capacity to act and regenerate the SMOTIES

small and remote place communities is supported by the collaboration among local stakeholders and the ten main partners², which include public institutions, design centres, creative agencies, national associations, and research centres. Within the project, the ten partners act, in fact, as *Nodes of Creativity*: they are in 10 European cities and have been chosen for the particularity of position, cultural uniqueness, development potential, and consolidated role in their creative sector.

Nodes of Creativity works with small and remote places as interlocutors, activators, and supporters of creative works to be anchored in public spaces through a shared methodology summed up in 5 work packages, including WP1 Project Management, WP2 Methodological Framework, WP3 Impact Analysis, WP4 Engaging the Locals (Co-Design), Learning (Masterclass and Training), Producing (Prototyping Studios), WP5 Dissemination and Exploitation of Results.

Methodology

SMOTIES takes a step further in the landscape of bottom-up and grassroots processes; the active involvement of people in the transformation of their existence, acting in their environment to achieve social change, has already been assimilated in the European context and has already grown into place in the urban structure, integrating creative people (designers/artists), local authorities, administrations, innovative companies, territorial actors, the third sector and representatives of active citizenship towards infrastructural changes (Montalto et al., 2019). These processes reveal a diffused awareness of specific problems, how to tackle them and bring to light common values and beliefs, increasing social networks in local contexts.

The geography of local contexts has activated multiple micro-spaces of best practices and evolved into systemic networks that demonstrate that even marginal locations have become part of global networks and spread their influence (Sassen, 2004). It is the case of ENoLL - European Network of Living Labs, ECBN - European Creative Business Network, FabLabs and Makerspace cooperation, Smart Cities joint actions, social housing foundations, etc. Therefore, we are in a dense network of connections linking local efforts and creating a flurry of initiatives and social change processes that have demonstrated a not yet fully exploited capability to reach the defined typologies of small and remote places and to turn their full range of participatory models (living labs, mobility systems, makerspaces, housing innovations) to fit into diverse contexts. These last have an additional component: they possess a generational multiplicity that could reinforce and highlight the quality of the knowledge transfer of the material and immaterial culture.

The design process that is leading to the establishment of creative works with/in the public spaces in 10 small and remote places with the help of 10 partners based in 10 European cities is having a short and mid-term impact in terms of reinforcing the identity of small places, showcasing their unique creativity, preserving their material and immaterial culture, and using design to build long-term development strategies.

2

Department of Design - Politecnico di Milano (Milan, Italy), Cité du Design (Saint-Etienne, France), Clear Village (London, UK), FH Joanneum, University of Applied Sciences (Graz, Austria), Urban Planning Institute of the Republic of Slovenia (Ljubljana, Slovenia), Estonian Association of Designers (Tallinn, Estonia), University of the Aegean (Ermoupoli, Syros, Greece), Zamek Cieszyn (Cieszyn, Poland), University of Madeira (Funchal, Madeira, Portugal), Alernance SLF (Reykjavik, Iceland).

To ensure the achievement of these impacts, the *Nodes* work with small and remote places as interlocutors, activators, and supporters of creative works anchored in public spaces through:

- A shared methodological framework that guarantees a baseline process for all partners of engaging local communities for audience development
- Transnational mobility of creative professionals to create a network of actors from small and remote places and to avoid the risk for the last of becoming culturally and socially isolated; this is also stimulating the creation of opportunities for long-term economic development
- Masterclasses and training for capacity-building purposes to improve the professional skills of the locals and create new job opportunities
- An evaluation of the impact to generate a long-term legacy in the involved contexts.

The shared methodological framework design converges into the *Smoties Toolbox* that all partners have tested in small and remote places. The methodology of the SMOTIES Toolbox revolves around a systematic and interconnected approach to concept development and impact assessment. It consists of six collections of tools/toolkits. These toolkits are designed to complement and synergize with each other, providing a comprehensive framework for project leaders. The methodology involves gathering and analyzing contextual information, envisioning desired future outcomes, and defining and assessing the project's impact. By leveraging the tools within each toolkit and integrating them across the system, project leaders can gain insights, set clear objectives, and evaluate their initiatives' social, cultural, economic, and environmental impacts. The methodology promotes a structured, iterative process, enabling informed decision-making and maximizing positive project outcomes. Through a combination of primary and secondary research, observation, and discussion, the SMOTIES Toolbox aims to uncover the community's key issues, organising them in guiding perspectives towards the future. These perspectives have been called *Windows on the Future* and are thematic lenses through which looking at small and remote places as seeds of the future and consisting of a set of possible scenarios based on the analysis of future trends. They have been designed to support a foresight process: project leaders can identify stakeholders and map the territory, gaining a comprehensive understanding of the local context. The SMOTIES Toolbox sets the foundation for effective project planning and ensures that initiatives are aligned with the specific needs and dynamics of the small and remote place, enabling laypersons and local stakeholders to articulate their expectations of prospective innovations (Heidingsfelder et al., 2015). This approach has been based on design futures studies (Amara, 1981; Candy & Dunagan, 2017; Candy & Potter, 2019; Dunne & Raby, 2013; Fry, 2020; Henchey, 1978; Hillgren et al., 2020; Voros, 2001, 2003).

Windows on the Future are set into five streams: "Project-based Communities" dealing with active citizen participation and new kinds of governance (Fassi & Manzini, 2021) *Fig. 2*, "Co-created ecologies" regarding creative solutions for sustainable living, "Beyond Tourism" exploring new paradigms of tourism as living an

authentic life, “Proud to be silver” focused on healthcare and wellbeing of the elderly people and intergenerational dialogue, “Distributed education” exploring the future of local cultural and creative knowledge. Each *Window* is structured as a positioning map identifying two future trends (axes) and four scenarios: the vertical axis is related to the engagement of the population – a focal point of our approach – and the horizontal one declined to each topic.³

3
The illustration of the *Windows on the future methodology* is illustrated in the forthcoming paper: Auricchio, V., De Rosa, A., & Monna, V. (2023). *SMOTIES: scenario building for creative solutions in remote places.*

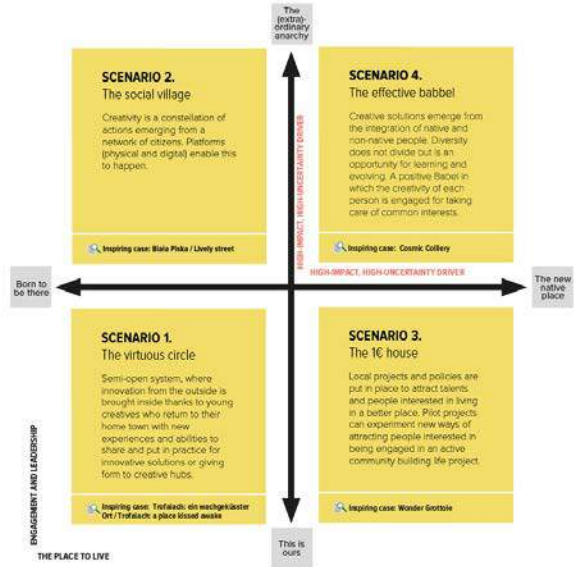
Window on the Future 1 “PROJECT” COMMUNITIES

Active citizen participation and new kinds of governance

KEYWORDS:

FUTURE GOVERNANCE, CITIZEN PARTICIPATION, CREATIVE CAPACITY BUILDING, DEMOGRAPHICS AND POPULATION DENSITY, INCLUSION

The scenarios in this *Window* have to do with the future of citizen participation and their ability to give form to shared future projects. Their common aim is to build resilient creative ecosystems for future development allowing the creation of an inclusive governance structure that can secure full commitment of the local rural community to their long-term goals. These scenarios build on the emerging trend of civic participation in governing local development, stretching this concept from sporadic projects and civic listening to a new form of governance led by creative citizens.



The exploration of scenarios is followed by the analysis methodology on people’s use of public space to familiarise themselves with how space, people, and actions are intertwined. It is based on a transdisciplinary approach between urban design, history, and environmental psychology. The analysis comprises a set of boards to report in-field analysis and observations of the interactions among people and places, a historical overview of the area’s development, and a geographical/morphological survey. Combining this analysis with the design opportunities coming out of the exploration of the scenarios, partners are founding the idea-generation process together with local stakeholders. This phase is helped by several activities provided by the program, such as masterclasses and training to link academia and the professional realm to in-field actions and the prototyping of solutions to test results on-site.

By answering the call for projects of the Creative Europe program, the proponents had a strong focus on the impact and legacy of the outputs and outcomes to be achieved; for this reason, the Toolbox also aims at supporting the impact assessment of each project, by identifying the possible impacts of a project in a small and remote place and evaluating them. Defining impacts in the meta-design phase of a project allows a better clarification of the project’s objectives. Through a co-design approach including all ten partners, SMOTIES defines result indicators to measure the meeting objec-

Fig. 2
Example of positioning map for the “Project-based communities” *Window on the future.*
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tives and the effects obtained by looking at its direct addressees and impact indicators about the successful influence on the economy and society beyond the direct interventions. This is an ongoing process expected to have a final set of instructions by the end of the 5th semester of the program.

The partners with the local communities and stakeholders have tested the SMOTIES Toolbox system to collect feedback and refine the tools: the final version will be published at the beginning of 2024.

4
The small and remote places are Basso Monferrato (Italy), Oberzering (Austria), Penmachno (UK), La Vallée du Dorlay (France), Joaveski (Estonia), Bobrek (Poland), Estreito da Calheta (Portugal), Apano Meria (Greece) and Polhograjski Dolomiti (Slovenia).

Expected and Ongoing Results

The project SMOTIES:

- has created a network of design-led *Nodes*, developing creative works with(in) small and remote public spaces using a scenario-building design methodology
- has engaged villages, settlements, provinces, and regions, also through the involvement of policymakers and representatives, to develop creative works in public spaces, including training and educational activities to improve the professional skills of the locals and create new job opportunities
- is supporting the creation of a network of small and remote places thanks to the transnational mobility of experts who are communicating and disseminating results
- is assessing the long-term impacts of the outputs and outcomes, starting from a participatory approach linked to design thinking and design futures approaches, engaging with local creative communities
- is turning experiences developed in creative works with public spaces into systemic models to influence the habits and socialisation of the beneficiaries and the spaces in which they happen.

These results are possible thanks to that methodological approach and deep diving into the context done by each partner. The strengthening of local networks of stakeholders and the dense program of activities has helped the *Nodes* not only to gradually step into the small and remote context but also to build relationships with the social context and ease processes to boost local creativity. Each partner has covered various environmental locations (from top of mountains to sea coastal), dimensions (from 30 to 1,500 inhabitants), and distances from the cities⁴.

The first results of the research are happening right now and show the peculiarities of dealing with small and remote contexts both from the research partners' point of view and the locals' one.

As regards the partners, the choice of small remote places to work with is often based on professional networks or direct knowledge of the places and people. Sometimes, these relationships are based on previous small projects, didactic activities, or first intuitions about places and people's potentialities not yet explored. The shared methodology helped the partners to have a coherent approach with local people and to explore scenarios and design opportunities with a list of tools that will make comparing the results easier and evaluating the impact more feasible. The *Windows on the future* framework

based on trends, European documents, and desk research adds consistency to the value proposition of the partners towards the local communities: having solid literature and best practices background and showing what is happening in the rest of Europe helped the partners to engage the locals with a strong trust and expertise.

Conclusions

At this point, three main insights emerged by meeting and engaging with local communities in the SMOTIES small and remote places **Fig. 3**. As regards the locals, the number of citizens in these places is so small that, often, some citizens hold different offices and roles (i.e., mayor, head of associations, local artisans, farmers, etc.). On one side, this phenomenon eases the decision process; sometimes, it may be an obstacle to moving forward. Secondly, the dimensions of the possible interventions are diverse and heterogeneous since local needs vary from context to context. There is such low quality or even absence of public spaces that minor interventions, such as basic urban furniture, renewal of street pavements, or small public art installations, could make a difference. This aspect makes evident the importance given to intangible yet impactful processes of social engagement, skills exchange, and support to policies that support the *creative milieu* of cities and neighbourhoods, leveraging the role of culture in addressing broader social and economic challenges. This perfectly matches the short and medium-term impact of outputs towards a long-term effect on the areas: acupunctural outputs (Jégou, 2011) could feed a more significant transformation of places due to a renovated interest and reactivation of social dynamics. Finally, the number of local meetings reinforces and enriches the local network of stakeholders and citizens, reaching out to people with little or no involvement. These interactions boost conversations and debates for exploring ideas and solutions with the SMOTIES partners.



Fig. 3
Co-design activities in
Albugnano (Asti, Italy).
Ph. Polimi DESIS Lab

SMOTIES aims to contribute to reinforcing small places' identity and transform sustainable opportunities into long-term development strategies. They are significantly improving the capacities of remote places to become part of a transnational network thanks to newly created synergies while being firmly embedded in the local context and establishing an innovative view of the local creative industry and endemic design strategies. The potential of transferability still needs

to be understood throughout the development of the SMOTIES task about impact assessment (through the definition of results and impact indicators) of such actions in remote places. Several activities have already been completed, including 41 meetings with the locals, 15 masterclasses and training sessions to engage students and professionals in defining solutions using the Toolbox, 16 travelling talks about communicating the project and disseminating the first results, 12 prototyping sessions to test the solutions and one publication with the collection of the European best practices located in the ten countries involved in the program.

This process helps the partners to explore the local context, to support the communities renew of their sense of belonging to their territory, to investigate design opportunities and future pathways of change, reinforce local networks, prototype first solutions, and assess short/medium/long-term impacts. The network is constantly meeting to keep track of the ongoing activities, aiming at fulfilling the complete set of goals of SMOTIES research project.

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https://www.eacea.ec.europa.eu/news-events/news/new-publication-creative-europe-2014-2020-gender-equality-sustainability-and-digitalisation-cultural-2022-02-21_en

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Culture-Based Innovation: A Localized Approach for Designing

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Abstract

Egypt's craft industry encompasses many dependent businesses, while crafts are slowly dissipating in the flourishing digital age, designers are emerging and becoming more substantial. Handicrafts are actually in their majority environmentally friendly, offer a quick and short monetary cycle, and most of all are a reflection of the local culture and identity. Globally, cultural inspired designs can easily be trendy and fashionable. This paper argues that designers play a major role in solving this matter. Culture integration into the new designs is rather challenging as there is no solid theoretical framework linking design and culture. Designers have the ability to address how core components of culture can be embedded in innovative functional objects. The paper analyses the role of design from the outcome of local startup project and based on a design intervention conducted in collaboration with the International Labor Office (ILO) in Egypt.

Keywords

Culture-based Products

Product Innovation

Egyptian Crafts

Design Practice

Design and Social Innovation

Handicrafts: Current Perspectives

The present status of Egyptian handicrafts is unappreciated and undeveloped. Many Egyptians view handicrafts as purely decorative and not practical, and they make these items primarily for tourists. Despite this stigma, handicrafts are often better for the environment, have a shorter financial cycle, provide economic independence to women and families without other means of consistent support, and, most importantly, are a representation of the local culture and identity. This means that institutions in authority have a role to play in advancing, modernizing, and repositioning the craft manufacturing sector. The goal of making such a contribution is to better the production, design, technology, innovation, and quality of life of craftsmen (Dash, 2010).

The preservation and growth of handicrafts depend critically on their cultural significance. Razzaghi, and Ramirez (2005) argue that items having a cultural character are more appealing and are consequently seen as a source of satisfaction to customers. It's a personal expression of the owner and maker, which often inspires new and interesting ideas. Culturally influenced designs may easily be popular on a global scale. This will eventually lead to parity between domestic and global markets. There are five main reasons why the cultural factor is often overlooked when creating products. It's challenging to "globalize" these items because of the high cost of R&D, the inexperience of most designers with cultural integration, and the difficulty of designing for many cultures at once. Consumers would rather buy mass-produced, technologically advanced products than artisanal, one-of-a-kind objects. Speaking in general, but with special emphasis on Africa, Moalosi, et al explains that there is a lack of in-depth research and appropriate methods in addition to the nascence of a theoretical framework that combines design and culture. (Moalosi et al., 2007)

To conclude this section, crafts are fundamental to creativity and serve as a tool that expresses the country's image in international markets. As a result, it is now being used as a creative catalyst in both industrial and communication designs. This is due to its ability to distinguish between local and internationally renowned designs (Dash, 2010).

Italian Findings

For a long time, the idea of handicrafts as a vital economic sector was overlooked in favor of other mass manufacturing businesses. For example, Bertacchini and Borrione (2013) pointed out a debate that has been going on in Italy for some time despite the country's long history of artistic achievement and the prevalence of design in its consumer goods. Specifically, 2007 was the first year that a report on Italian inventiveness was published. Focusing on the creation of new cultural and *creative output* rather than only preserving existing works of art is a key recommendation of the 2007 report on the creative industries. They use the UNCTAD 2008 report to further explain that "looking at the external trade statistics of creative goods,

Italy ranks among the leading creative economies when design and fashion items are included. Consequently, this paper argues that the Egyptian economy would benefit greatly from the handicrafts sector if the sector adopted three interdependent factors: designed marketing strategies, the addition of new values (mainly cultural), and innovation.

Designed Marketing Strategies

Researching about marketing strategies will compile a lot of literature, however very few actually relate design to the marketing strategies. Bruce and Daly (2007), suggest that firms should evaluate the role of design from a marketing perspective; thus, the term *designed marketing* was established. The relationship between managing design and marketing, nevertheless, is not entirely obvious. The significance of managing design arises from the need for marketing and design skills to be able to adapt to user's needs and then communicate brand values through not only the product but through its way of showcasing whether packaging, brand image, or advertising. Design is essential since it is the "*visual manifestation*" of marketing and thus communicates the brand's values to consumers. At a certain point, design was seen only as a functional tool to support marketing. Nowadays, however, designers are more regarded for their ability to make strategic decisions and contribute to leadership without direct supervision. In addition, design also boosts innovation, improving a company's intellectual property and ultimately its competitive edge. This knowledge is crucial because it recognizes design as a tool for sustainable innovation and creativity.

Furthermore, studies have shown that a marketing approach aimed at local customers may succeed in reaching an international clientele. For instance, Balcioglu and Emgin (2014) noted that Western models were already popular among Turkey's higher classes; thus, Turkish designers just imitated them. Local Turkish designs emerged on the global stage in the 1990s, after the country's economic rise. Turkish designers have improved the home market in hopes of gaining a worldwide audience, and this is largely owing to the pragmatic design approach adopted from local cultural resources. The goal of this strategy was to promote Turkish design internationally as a brand, therefore meeting the desire for novelty in foreign markets. Taiwan has used a similar tactic. Lin claims that Taiwanese designers are becoming confident in their ability to introduce their own cultural style to the global economic market (Lin, 2007).

Adding New Aspects; Reintroducing Cultural Values

According to Balcioglu and Emgin, (2014) The Turkish designers' emphasis on national cultural notions was an effort to develop a *national design style*, rather than a strategy for increasing their part of the global market. Lin (2007) claims that cross-cultural design will impact future design appreciation. This means that designers need to expand their experiences not only with cross-cultural factors but equally important are the knowledge of local elements. Inter-

estingly, Balcioglu and Emgin (2014) argue that understanding the importance and positive future effects of the new design strategy, the Turks coined the concept of *Turkishness of Products*. The term triggered the designers to opt for Turkish cultural products which prompted Turkish designers to re-identify their own local culture and represent it in an innovative modern way. The iconic Turkish tea glass in the form of a tulip is used as an illustration of this approach as this cup is considered the *most Turkish* product. According to Kaygan (2006), a Turkish tea ceremony wouldn't be complete without this glass. Designer Erdem Akan gave this traditional Turkish custom a modern makeover, resulting in the *East Meets West* tea cup seen in Fig. 1. Here, a traditional strategy was adopted in promoting a traditional object into contemporary technological conditions and aesthetic conventions.



Fig. 1
Designer Erdem Akan,
East Meets West teacup.
<http://www.erdemakan.com/accesories/east-meetswest-teaglass.html>
(accessed 20/04/2016)

Innovation: Introduction of New Concepts and/or New Functions)

Innovation is an important aspect because old-fashioned products do not appeal to clients. In addition, being updated with the changes in consumer tastes and preferences is what pushes artisans forward to change their crafts. Yet the new change should attract present customers, as well as encourage designers to work accordingly fulfilling the demands of customers. (Dash, 2010). Thus, according to Bruce and Daly (2007) design is fundamental to retaining success and maintaining competitiveness in the market. Consequently, designers and producers need to develop their creations, whether products or services, in order to be able to create new markets. New approaches emerged to create further market goals to either maintain current position or create new markets.

This paper has argued so far that local cultural elements are essential to developing a design strategy that results in a well-defined product identity, which is necessary for success in a global market. It is now common knowledge that including cultural elements in a product's design increases its value.

According to Lin (2007) Industrial Design plays the leading role in this process. He further forwards the notion that products created to emphasize local cultural elements are becoming more established in the design process. According to Dash (2010)

Designers are the ones who anticipate design-related problems, try to address them in light of what may be needed in the future, and ultimately enhance the existing product. Furthermore, design determines the products' shape, function, way to use, material, and manufacturing processes.

Egyptian Case Studies

Design interventions for the Red Sea Artisans

Within the framework of *Decent Jobs Egypt's Young People Project* created by the International Labor Organization (ILO) in Cairo, a design intervention was conducted for business development services for Red Sea artisans and handicrafts sector to maximize its potential in employment creation and to make the Red Sea handicrafts sector attractive. Believing that design has an advantage in fostering the external and internal rational between producers, products, and markets broadens the scope of the core value chain players (artisans/NGOs.). Therefore, an intervention to build new capacity and to create a supportive enabling environment became crucial. Essential to this was to develop a range of new products that turn these crafts into lucrative businesses for the artisans and attract new entrants to learn and practice the craft. For these tasks a group of 8 designers with various design and practical backgrounds were selected including product; graphic; and media designers. They have been invited to visit the project locations in the Red Sea area to familiarize themselves with the people, the crafts and the locations to figure out the uniqueness of each aspect.

The assignment started its first phase which involved the review of available data about the sector in the Red Sea and a field visit to the areas of focus to form an initial idea about the situation of the sector. The initial field visit included interviews with artisans at the Red Sea. The focus of all interviews was the quest for available data and information about the handicrafts sector and the artisans in the areas of Ras Ghareb, Hurgada, Safaga, Qusseir and Shalateen. The needs assessment survey covered the two main components of the sector: the traditional products produced by 99 artisans and combined by a semi-structured interview with three NGOs working in these areas. At this point and due to the huge data extracted from the survey and interviews, we focused on the need for new designs as the crafts in the Red Sea lend themselves to endless opportunities and diversity for development. However, as illustrated in Fig. 2 marketing, raw materials, tools and money are the most frequently mentioned needs to make the Artisans better at their crafts.

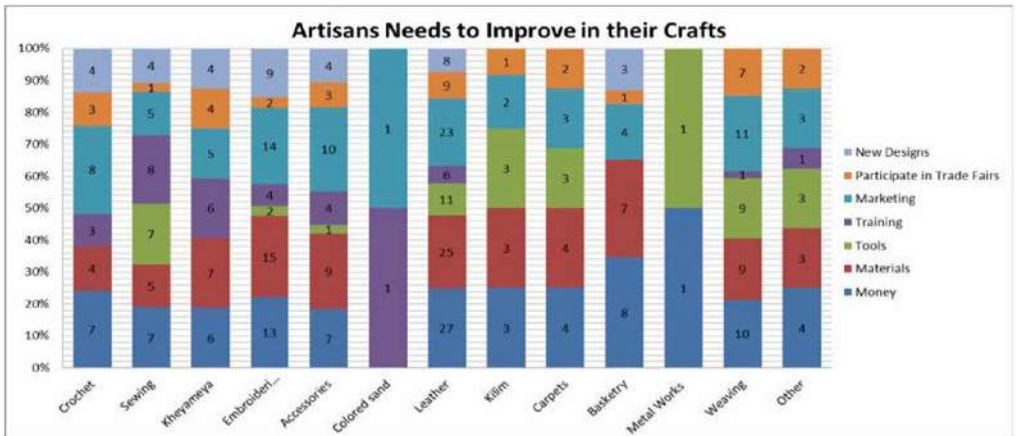


Fig. 2 ILO report. Marketing, Raw Materials, Tools and Money are the most frequently mentioned needs to make the Artisans better at their crafts.

Nevertheless, functionality, trendiness, quality of materials and level of finishing were all essential elements in the process of product development. The products made by the designers are appropriate for everyday use. By following clear instructions provided by designers, individual producers from the artisans' group have been selected to perform direct intensive work (through workshops) resulting in the development of a range of new high-quality products that are appropriately priced, saleable, and appropriate for local, national, and international markets. By using a strategy of coaching, a range of final products including basketry, leather products, kilim, crochet, and khayameya work were developed in the form of prototypes with packaging materials from selected producers, complete with pricing and quality standards, which can be offered to existing and new customers. Samples of the products developed over a one-year project can be seen in Fig. 3.



Fig. 3 ILO project. Design intervention results.

Packaging was an integral component of the marketing strategy and supports the identity of the brand. The designs of eco-friendly packages that suit the various products accommodated the products' sizes, shapes, fragility, travel, in addition to appeal. The production of packages from recycled paper or local fabrics has been considered. On the other hand, an inside-out marketing perspective contributed to the promotion strategy and plan to cover the promotional messages by creating the brand identity for this project by designing the logo, promotional materials, hang tags, business cards, packaging materials and providing the storytelling. The project also involves providing the storyboard for the promotional movie and a plan for the launch of the brand. (Rifaat & Al Gazzar, 2013)

The role of the designers in the implementation phase was mainly supervision, and to follow up the steps of productions. This role was divided into 2 essential phases: The *Roll Out phase* & the *Exit phase*. In the Roll Out phase the designs and technical training were accomplished in parallel with capacity-building training and launching the Red Sea crafts brand. In the Exit phase several activities were repeated, namely a design and product development project for new items to be added to the collection, the development of a website for the brand, the organization of another round of technical and capacity-building training for new member NGOs and artisans in view of creating a pool of in-house trainers.

The role of design from the outcome of Local Startup Project

In recent years, several local startups projects in Egypt with a focus on innovating current craft products and introducing new designs have been initiated and successfully implemented to transform traditional crafts into modern and innovative products. *Menn Baladha* project presents a case study in which the goal of students and lecturer was to establish a link between design and craft pottery and its richness in culture and authenticity. Rather than seeking new products, the involved designers tried to re-add new functions to the simple Egyptian traditional clay pot used for baking food in ovens called *Tagen*. This product is known to be inexpensive yet healthier than most metal pots. Egyptians commonly believe that the taste of foods baked in a Tagen is much more refined than dishes cooked in other containers. The Tagen was chosen as the first clay example to be redesigned for many reasons: First, it is a very traditional Egyptian product with roots extending to ancient Egypt. Second, many Egyptians tend to neglect the Tagen since it does not meet the modern life style; it reflects a poor personality on the dining table. Third, many users do not prefer the Tagen due to difficulties in handling and cleaning. Fourth, the Tagen is a healthy product that does not react with the food it contains.

The process started with intensive research and field visits by the students in which they observed the traditional Tagen production techniques and tools used. The students gained a lot of insights by observing and discussing with the craftsmen and the workshop owners. Market research was also conducted and Egyptian consumers were interviewed (class A, age group 30-40s targeted) regarding

their conception of the cooking utensils. The core of design process was to analyze the gathered research data and field experiences in order to initiate inspiration, fresh preceptive, and redefine the cultural features in a modern way. The following step was visualizing different concepts. The main obstacle was manipulating traditional knowledge and adding to a deeply rooted culture-based product that has fulfilled its purpose for thousands of years. Another obstacle was the clay material itself; how to modernize something perceived as archaic the way clay is seen by the target group.

The design solutions were addressed through a design-oriented approach to improving the traditional Tagen's usability and by introducing new practical features to the cooking techniques. The new items added to the Tagen highlight how it functions: first, the edges became thicker for better heat distribution. Second, a lid was introduced not only to maintain the gained heat inside the Tagen, but also to create a compositional balance between the pot and its lid and added greatly to the appearance and status of the product. Third, two sturdy handles were created to achieve more control and balance while manoeuvring. Fourth, a second tagen was designed to fit one on top of the other. The upper Tagen had a perforated base to function as a steamer, allowing the user to cook two different dishes simultaneously. Fig. 4



Fig. 4
Menn Baladha local start-ups project. Design and craft pottery development

In addressing the problem concerning the archaic appearance of the clay material and in order to publicize different aesthetic senses, the visual values of the Tagen were reconsidered by concentrating on its surfaces. The lid, as well as other parts of the Tagen, were painted either with plain vivid colors or with added patterns evoking a unique emotional character for each Tagen.

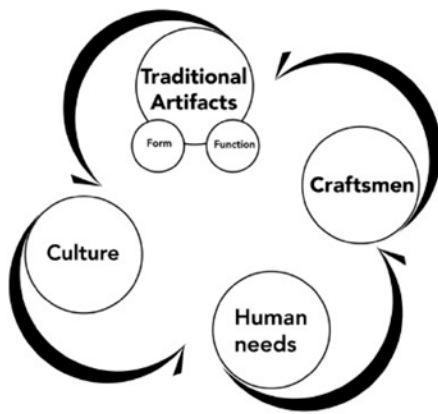


Fig. 5
The four factors necessary for developing handicraft products.

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A positive intervention in the community is one that builds on existing relations and promotes synergies. To start, it is necessary to assess the current existing handicrafts sector to see if it fulfils the functional and cultural needs of the intended target groups. Contemporary and updated human needs must be observed and defined carefully in order to guarantee an innovative product that meets a need. The handicrafts community, whether individual artisans or NGO board members should focus on developing the sector and be willing to work together and cooperate to maximise the handicrafts business for the best interest of the artisans. The craftsmen should avoid resistance in accepting new ideas and techniques that are different from what they have been doing traditionally for ages. Innovative products encompass not only the form, but also the function whether traditional, added, or introduced. Furthermore, the production material and techniques should be given prominent care. As argued earlier in this paper, the cultural aspect of the newly introduced products is very important as it not only helps market the product to locals, but also gives it a competitive edge on an international level. The semantics of any product developed along the lines of a cultural background give it a unique identifiable character.

Evaluation and Conclusion

The strength of design lies in approaching problems from different perspectives with the aim of not only developing new expendable forms or functions that are re-marketed but also managing the situation while respecting its cultural and social environment. In the Egyptian context, design emerges as a separate entity that does not respond to many issues when it comes to the integration of culture in design. Findings from the literature presented and the participation in the development of Egyptian crafts indicated that traditional crafts possess the elements of development and modernization, but mostly suffers from the absence of contemporary needs of daily life products represented in the creation of form and function. In addition to the previous fact, the craftsmen are the heroes of this dilemma as they are the designers and marketers simultaneously. Handicrafts practices in Egypt remain a reproducible activity of cultural patterns and the designs are not in touch with the market trends and fall short of having consistent quality standards. As for heritage crafts, while

fully respecting their ethnic identity, they still lack quality in finishing and their designs could be developed to appeal to larger segments of consumers (ILO, 2013). The cycles illustrated in Fig. 5 show the four factors necessary for developing the handicraft sector products that need a level of integration that should be monitored and understood.

The argument concerning the relationship between the designer and craftsman and the role of designers in the craft section has already been demonstrated by Dormer, (1997) in his edited volume *the culture of craft* the designer is not 'expendable' as long as they are not designing for their own needs. Their role and importance stem from the fact that they are able to design according to the needs of others. Building on this notion, this paper argues that the Designer is the key player in connecting the four elements demonstrated in Fig. 5 in order to reach a highly innovative product able to compete on many levels. Through education, skills, and training, the Designer has the ability to comprehend and transform established cultural elements as well as new trends, materials and techniques towards creating new products. They also have the ability to communicate on different levels, macro and micro, using sophisticated terminology when dealing with international entities in marketing for example and local language when collaborating or instructing a manufacturing process to small workshops. Because marketing requires branding, As El Anssary (2009) demonstrates that the designer has a holistic approach to the creation of a new product as their role extends to the creation of a brand that gives the product a well-received market value. According to the case studies discussed above, and following the need assessment findings, and the analysis of the existing production processes of some crafts sectors in Egypt with emphasis on the two case studies presented in this paper, the conclusion is reached that the sector will only be attractive to craftsmen and capable of job creation when its production processes are under the influence of experienced designers. Finally, the role of the designer is not only to create profit, but he also needs to make a difference in society.

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Burning Approaches to tensing the Present: a new Political Dimension of Design

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Abstract

The contribution presents a preliminary reflection on the nature of design in our “post-political” scenario. It argues that design increasingly embraces critical thinking and antagonistic practices to push on social reality and bring about change. The document explores theoretical reconfigurations of design drawing on the ideas of contemporary thinkers and examines case studies of critical-making approaches that support the proposed critical framework. The primary objective of the contribution is to uphold the inherently political nature of design. It underscores the significance of “disagreement” as a foundation for the project. The investigation calls for critical thinking and the necessary process of “decolonization” within the field of design. The overall argument advocates for a political design that embraces dissent, criticality, and speculation, intending to reshape the boundaries of the discipline and address the crises and conflicts of our time.

Keywords

Political design
Distribution of the sensible
Minor design
Critical making
Dissent-oriented design

Design in crisis: uncovering collective narratives and reshaping the collapsing world

Undoubtedly, design is one of the contemporary disciplines deeply influenced by the 20th century. While acknowledging the necessity to constantly redefine its scope of action and boundaries, its mandate, and its cultural, social, and political responsibility, design emerges as the driving force that shapes the world we live in today, reflecting the transformations and profound upheavals that unfolded throughout the century. However, in the face of a global historical reconfiguration and rapid changes across various domains, design finds itself embodying a narrative of crisis. The question arises: can design exist without a minimum degree of stability? The current state of flux and uncertainty requires constant questioning of who we are and what we are capable of. In *The Third Unconscious. The Psycho-sphere in the Viral Age* (2021) Franco Bifo Berardi characterizes the current catastrophic situation as:

the end of human history, which is clearly unfolding before our eyes; the ongoing disintegration of the neoliberal model and the imminent danger of the techno-totalitarian rearrangement of capitalism and the return of death to the scene of philosophical discourse, after its long denial by modernity. (p. 31)

The notion of an “end of history” (Fukuyama, 1992) emerged after the fall of the Berlin Wall and the decline of the Soviet regime, suggesting that conflicts had been resolved and consensus prevailed, ushering in an era of stability and prosperity under the banner of liberal democracies and capitalist economies. This trend, rooted in the belief in objective historical development and a linear progression, positioned liberal democracy as the ultimate and universally embraced social model. However, the reality is right before our eyes. Ecological catastrophes, military and social conflicts, financial collapses, and economic crises, the proliferation of artificial intelligence and big data, technological and digital divides, the extension of algorithms into our daily lives all serve as a negative crescendo, highlighting how a world shaped by the neoliberal capitalist model is far from the best of all possible worlds. It's not just about climate change, as Donna Haraway points out in *Staying with the Trouble* (2016):

It's more than climate change; it's also extraordinary burdens of toxic chemistry, mining, nuclear pollution, depletion of lakes and rivers under and above ground, ecosystem simplification, vast genocides of people and other critters, et cetera, et cetera, in systemically linked patterns that threaten major system collapse after major system collapse after major system collapse. (p. 100)

In the face of this ongoing systemic crisis marked by instability and fragmentation, can design still uncover collective narratives of critical value? Is there an extraordinary opportunity for design to reshape the world and give significance to the interconnectedness of humanity and seemingly insignificant details?

The inadequacy of the design discipline in reading and understanding the present is evident. Design faces an epistemic

debt when it comes to understanding the interconnectedness and intricate dynamics of profound planetary changes and technological dominance. Thus, the discipline of design often lags behind, clinging to outdated problem-solving perspectives that distort our perception of the present and limit our ability to envision the future. Instead of engaging in thoughtful foresight, it produces simplistic, momentary, and conceptually impoverished utopian models. Design is entangled with positional privilege, the denial of otherness, and various forms of negation that depict a weary world in need of care, rehabilitation, and repair.

Towards political design: embracing dissent-oriented approaches in design practice

It is time for us to assume full responsibility. One thing is clear: in this reality, the role of the designer should engage with the “political dimension”, stimulating knowledge processes and harnessing its inherent power to shape potential worlds. We must question the belief that progress, whether technological or social, automatically leads to better living conditions. In this context, we can confidently say, “Welcome to interesting times!” (Žižek, 2012), where we have the opportunity to decolonize our imagination, explore new theoretical and operational territories, shape new “adjacencies possible” (Kauffman, 2000) and fill them with new trajectories and resistances, even if they are not yet defined.

Like all conversations, when discussing the political dimension of design, it is important to explore the convergence of meanings. The term “political” in this context draws from the ideas of post-foundationalist, post-Marxist, and agonistic political theorists such as Chantal Mouffe (2005; 2013) and Jacques Rancière (2000; 2004; 2007). These theorists highlight the inherent ambiguity of politics and the distinction between the consensual and “dissensual” dimension of practices in civil coexistence. “Politics” refers to a mode of deliberation, governance, and administration of collective life, characterized by varying degrees of consensus but always contingent. However, “political” signifies dissent, the disruption of established orders, and the conflictual negotiation that allows new and unpredictable orders to emerge.

According to Chantal Mouffe, Western governments represent different variations of the neoliberal model, which seeks to suppress moments of conflict and hinder genuine political debates. They strive to construct an illusory consensus that is ultimately unreal. Mouffe (2005) points to the political philosophy of liberalism and the concept of democracy derived from it, clarifying that:

[...] the dominant tendency in liberal thought is characterized by a rationalist and individualist approach which forecloses acknowledging the nature of collective identities. This kind of liberalism is unable to adequately grasp the pluralistic nature of the social world, with the conflicts that pluralism entails; conflicts for which no rational solution could ever exist. The typical liberal understanding of pluralism is that we live in a world in which there are indeed many perspectives and values and that, owing to empirical limitations, we will never be able to

adopt them all, but that, when put together, they constitute an harmonious and non-conflictual ensemble. (p. 10)

Moreover, Mouffe argues that the postmodern condition has led to the disintegration of the agonistic horizon of politics, primarily due to the prevalence of aesthetics in late capitalism. This has created a hedonistic culture that lacks space for imagining and designing antagonistic experiences. Similarly, Slavoj Žižek contends that nowadays we are confronted with a negation of politics, a post-political condition that not only “represses” the political but effectively “forecloses” it (Žižek, 1999, p. 35). Within these liberal systems, there is a notable tendency to exclude moments of social conflict, which frequently arise from the inherent contradictions of the capitalist model, from any form of representation or narrative, except through exclusion and moral condemnation. Consequently, these moments of conflict lack the necessary avenues for development, denying them the space and time needed to manifest in new forms and expressions.

Jacques Rancière (2010) argues that politics emerges precisely through disagreement, dissensus (*mésentente*), rupture, and disorder within a shared order. It involves destabilizing the established “order of the sensible” by disrupting the assigned place of a body or altering the destination of a place. This process reveals what was previously unseen, amplifies speech that was previously silenced, and transforms what may have been perceived as mere noise into meaningful discourse. As Rancière (2004) claims:

[politics] is a delimitation of spaces and times, of the visible and the invisible, of speech and noise, that simultaneously determines the place and the stakes of politics as a form of experience. Politics revolves around what is seen and what can be said about it, around who has the ability to see and the talent to speak, around the properties of spaces and the possibilities of time. (p. 13)

The concept of a “distribution of the sensible” (Rancière, 2004) comes into play, referring to how sensory orders in society reproduce and enforce divisions. This notion determines who has the privilege to see, hear, and participate in debates, while others are excluded or made invisible. It establishes a visible and recognized “community of sense”, while those outside of it lack the common space and time to experience alternative ways of perceiving the world. They are unable to see what is not intended for them to see, hear what is not intended for them to hear, or discuss what is not intended for them to discuss (Keshavarz & Mazé, 2013, p. 13).

At this juncture, it becomes evident how the concepts of “dissensus” and “antagonism” challenge the idea of design as a neutral and transparent endeavor that establishes a regime of meaning, thereby reinforcing power dynamics and politics inherent in current institutions. Moreover, “dissent-oriented” approaches in design provide means to intervene and disrupt established sensory orders, fostering innovative thinking and shifting the focus from a level of (re)production to one of proposition. This realm engenders a new cultural paradigm that reestablishes the political role of design, one that refrains from excluding moments of social conflict from any representation or narrative of the world. As a result, design, with

its emphasis on the social organization of everyday practices, can re-engage with power relations and influences, discerning fresh terms and themes for contestation and novel trajectories for action (DiSalvo, 2010, p. 6).

Embedding minority, speculation and critical making within the political design

Engaging in discussions about dissenting design entails inherent risks, as it requires undergoing paradigm shift, altering perspectives, and relinquishing comfortable positions. Emphasizing the broader context of the necessary “decolonization” of normalized thinking, Camillo Boano (2020) highlights the significance of the “minority” as a potential framework for the project.

The approach of minor design effectively tackles the crucial conflicts present in our contemporary reality. Instead of providing definitive solutions, it disrupts prevailing disciplinary norms and fosters alliances. It serves as both a “space of crisis” and a “place where light gets in” (Boano, 2020, p. 10-11). Therefore, the minor is a crack, a “disagreement” within a “constellation of thought” that signifies a position where partiality, not universality, is the condition for constructing new meanings.

Boano argues that the resurgence of the minority as a framework aims to shift the discourse away from focusing solely on domination, diffusion, commodification, and communication inherent in contemporary design. Instead, it seeks to promote an alternative practice of thought and action, advancing speculative propositions. Minor design should not be seen as an inferior or powerless undertaking incapable of concretely responding to crises and manifesting itself. It is not marginal, external, or devoid of agency. Rather, it represents a distinct intensity of design, a “critical practice” that continually reevaluates the relationship between critique and project.

By incorporating the concept of minor design, political design acknowledges the importance of minor perspectives, critical thinking that finds concreteness through critical-speculative practices and translates into objects that narrate alternative interpretations of the world, stimulate debate and reflection, and propose new behaviors and ways of coexisting. As a critical practice, political design recognizes that the crises we face today require more than simple solutions. It acknowledges the complexity of our socio-political fabric and seeks to unravel the layers of discipline that maintain the *status quo*. By engaging in alliances with diverse “agencies” (Latour, 2005), political design endeavors to enact tangible transformations and politicize its impact on society.

In this context, political design becomes a platform where different intensities of design converge. It invites designers, practitioners, and users to challenge prevailing paradigms, embrace alternative perspectives, and set problems that address the critical conflicts of our time. Through immanent critique, political design uncovers and amplifies the sporadic thickenings, fragments, hints, and makeshifts that hold the potential for transformative change. By merging dissent, decolonization, and criticality, political design emerges as a powerful force capable of reshaping the boundaries,

ideologies, and practices that shape our designed world. The corrosive attitude and the desire to deconstruct a system find common ground in two controversial movements in design culture: the Italian Radical Design movement of the 1970s and the English Critical and Speculative Design of the 1980s. Both of these design currents emerged during different periods of crisis demonstrating the urgent need to react by developing alternative cultural proposals capable of dismantling an outdated system of values.

During the late 1960s and 1970s, Radical Design represented a disruptive stance against the social, political, and industrial systems of that time, as breaking away from the past was intended as a requirement for a new project that surpassed the utopian exercises of the 1960s. As Germano Celant (1972), who coined the term “Radical Design” in 1966, asserted:

All the new Italian architecture – Archizoom, SuperStudio, etc. – has declared that its objectives are conceptual and behavioral. By proclaiming itself radical, it no longer wants to be commercialized or alienated, nor does it want to give up its ideas and expressive attitudes. It is an architecture that has no intention of being subservient to the client or becoming its tool; it offers nothing but its ideological and behavioral attitudes. (p. 382)

Groups such as Archizoom, Superstudio and Global Tools, along with influential figures like Ettore Sottsass, Gianni Piretti, Andrea Branzi, and Ugo La Pietra, have actively engaged in critical practices that seek not to domesticate the paradoxes of contemporary society in a reductionist manner, but rather to bring them to the forefront and make them more explicit and tangible through awareness, provoking thoughts, and inspiring potential for change.

Following the economic boom of the 1980s, the theoretical legacy of Radical Design inspired Anthony Dunne and Fiona Raby’s Critical Design, as exemplified in their influential book *Design Noir* (2001) and *Hertzian Tales* (2006) by Dunne alone. Drawing inspiration from the Radical Design movement, Dunne and Raby’s critical approach establishes a deep engagement between design and capitalism. It suggests the exploration of speculative and rhetorical potential inherent in design, employing futuristic scenarios and shifting the focus from the final product to the medium itself. By embracing this critical and reflective framework, Critical Design employs speculation as a *dispositif* to construct scenarios and fictions that “can act as a catalyst for collectively redefining our relationship to reality” (Dunne & Raby, 2013, p. 2).

Dissent, Scarcity, and the In-Between: Exploring Critical Design Practices

The critical practices approach can be explored through case studies that exemplify dissent, decolonization, and criticality within the design realm. Three noteworthy examples can be Ernesto Oroza’s “disobedient re-design”, Vicky Katrin Kuhlmann’s *The Volume Economics. Design Scarcity*, and Martina Muzi’s *The Feminine Space In-Between*. These case studies offer insights into how design practices can challenge norms, provoke reflection, and propose alternative visions.

Ernesto Oroza's "technological disobedience" embodies a captivating instance of critical design practice that embraces a conflictual dimension through acts of disagreement. By exploring and experimenting with immediate conditions, Oroza seeks to extend and subvert the possibilities within systems. For instance, *Rikimbili*, a bicycle with an artificial kerosene engine in a plastic bottle, key-copying machines powered by washing machine engines and television aerials crafted from tin plates sourced from canteens, closely embody the principles akin to hacking. These practices push the boundaries of systems, altering their logic and expanding their limits (Oroza, 2012). This resonates with the Neapolitan "philosophy of the broken", observed by Alfred Sohn-Rethel (1929/2009), where objects are reimagined and repurposed beyond their original use. By forging experimental connections with matter, disobedient re-design unlocks possibilities for design practice, challenging norms and expanding boundaries.

Vicky Katrin Kuhlmann's project, *The Volume Economies. Design Scarcity* (2014) delves into the concept of "finitude" (Pievani, 2020) and the artificial scarcity that we have created to sustain our economy. By challenging conventional thinking and proposing alternative approaches to resource distribution, Kuhlmann questions established power dynamics embedded in our economic structures. In the envisioned system, each individual possesses a designated "volume" to store belongings, encouraging a shift from individual ownership to collective responsibility. This approach fosters reflection on needs versus desires and underscores the political agency of consumers in influencing the market through deliberate choices. Through her project, Kuhlmann prompts a critical examination of our relationship with material possessions and advocates for responsible consumption from a political perspective.

Martina Muzi's manifesto-like project, *The Feminine Space In-Between* (2013), addresses tensions within design and the female condition within a neoliberal economy and presents a thought-provoking design approach focused on the evolution of nomadic living. Muzi emphasizes the interconnectedness between places, possibilities, and life itself, highlighting the social and personal struggle of living an "in-between" world, becoming, such as seeking employment, a home, and spaces that facilitate valued practices. As we are in the world living our fragile body, the only certain home, Muzi seeks a place that exists among possibilities. These scenarios challenge the prevailing paradigm where individuals are reduced to fragmented "scripts" (Akrich, 1992) for capitalist exploitation. It underscores the need for critical engagement, especially within the design field, to shape these phenomena and create alternative realities. Aligned with the concept of minor design, the project aims to break free from deterministic perspectives that enforce a singular worldview and design approach. It advocates for the materialization of a "pluriverse" (Escobar, 2018) where diverse and unforeseen forms of life can be recomposed and recreated. Aligned with the concept of minor design, the project aims to break free from deterministic perspectives that enforce a singular worldview and design approach.

Rethinking Design: Towards a Political Practice of Global Transformation

The design field currently faces global crises and profound transformations, which challenge the prevailing narrative of stability and progress. To reshape a collapsing world, design must embrace its political dimension and uncover collective narratives, departing from traditional approaches that fail to address the complexities of our time. Through dissent, criticality, and decolonization, design becomes a catalyst for debate, reshaping boundaries, ideologies, and practices. In our fragmented world, design holds the power to inspire meaningful action and forge a future of possibility.

The showcased critical practices seek to transfer the provocations, challenges, and issues inherent to the realm of mass consumption, granting them a meaningful purpose. In this process, designers adopt a strongly corrosive attitude, shifting “from problem-solver to a problem-finder” (Marenko, 2018), employing a constant investigative logic focused on constructing tools for reflection. To conclude, we can finally establish that while design alone may not have the power to save the planet or fix all the world’s problems, it does have the potential to change the way we think.

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Design Resistance. Material Solutions for Local Remoteness

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Abstract

Material design and indigenous knowledge are more often intertwined in the contemporary practice of design. Sustainable design is evolving towards discourses that stress the relevance of local interventions and the diverse contribution native cultures can give in shaping post-developed societies. This paper addresses the topic of endemic material design in decentralised areas through Material Driven Design experience by analysing the project called Viral Nature, a material research and design of a composite material able to host vegetal life and attract biodiversity. Originally formulated as a potential design intervention against soil degradation and desertification, nonetheless, the exposure of Viral Nature artefacts to the public showed its potential to be employed as a communicative medium to foster human feelings of environmental empathy. A case study to display a design trend leading toward resistant practices of biointegrated design, to investigate and hypothesise how endemic DIY-Material Design strategies enhance the functionality of the material experience and encourage a change of paradigm towards alternative solutions for the pluriverse.

Keywords

Design resistance

Materials

Local remoteness

Indigenous design strategies

Endemic design

Introduction

The practice of cultural resistance (Arnold, 1869; Gramsci, 1948-51) is embedded in the DNA of material designers. Cultural resistance is fluidly involved with *design resistance* (Haraway, 2016) namely the aptitude of those performing design in complex and/or dire conditions facing the challenges nested in the practice of material design (D’Olivo & Karana, 2021). Due to the context, the practice of material design might need to rely on indigenous narratives and tangible solutions of *Lo-Tek* design (Watson, 2020) that mould the design exercise into endemic design responses. Despite the attention shown to the outcomes of these material praxes – inspired by and intertwined with local knowledge – scarce are the opportunities for the plurality of these works to receive structural support by the local or global infrastructure of production (Rognoli et al., 2011).

In the last decade, with the increase in popularity of the themes of circular and sustainable design, designers have focused on the issues of locality, indigenism and low-tech productions (Ravenscroft, 2021). Isolation, social and physical remoteness, the decentralization of creative forces have steered the direction of the design discourses and its urgencies, which now proceed towards ecologically and eco-systemically driven narratives (Braungart & McDonough, 2008). The decentralization of the design’s creative capital has accelerated the shift towards a post-industrial age, whilst the design discipline – evolved relying on politicised, globalised industrial processes – is struggling to technically support the intellectual shift currently in progress, compelling designers to find opportunities and solutions independently through always more frequent Do-It-Yourself (DIY)¹ expedients (Rognoli et al. 2015; Rognoli & Ayala-Garcia, 2021). Designers, therefore, might have to exercise their language with the support of contextual resources, both technical and material, a factor that naturally drives the design discourses towards post-developed scenarios (Escobar, 2015).

The project called *Viral Nature* is a material research culminated in the design of a biobased material. The design intention behind this work is to formulate an endemic design strategy to enhance the opportunities provided by the context for socio-cultural and environmental improvement, leveraging the experiential and emotional dimension of design to provide a comprehensive perspective on possible futures (Karana et al., 2018). This study focuses on the material research and philosophy behind the project *Viral Nature*, aiming to clarify the contribution that material design can bring to local regenerative productions and depleted environments.

Material Design for Local Variables

The project *Viral Nature* (VN), proposes a material instance able to constructively interact with the ecological surroundings following the trend of endemic design; it is the result of a study conducted in and for local contexts. From ‘one’ to ‘many’: starting from the issue of soil degradation and desertification in the Mediterranean area, Sicily specifically (Piccione et al., 2009, Cancellieri et al., 2017), a biomaterial medium² able to trigger and support vegetal life was devised.

1

Literally the activity of constructing or repairing things oneself; in the design field, this definition might be associated with self-production and experimentation.

2

The phrasing ‘biomaterial medium’ is used here to indicate the intersection of material design matters with matters related to biological beings and their cycles: a biomaterial is “a substance that is naturally produced, for example by plants or insects, and can be used as a material for making things or as fuel” (Cambridge Dictionary, 2021). In the context of Circular Economy and Bioeconomy “biomaterials” are meant as “materials made of biological resources” (European Environment Agency, 2018). In *Biodesign*, this definition may be a synonym of “bio-based material” or may refer also to materials made “of, with, or from biology” (Ginsberg & Chieza, 2018). Retrieved on May 6, 2022, from: <https://jods.mitpress.mit.edu/pub/issue4-ginsberg-chieza/release/5>

Indigenous and scientific knowledge of the ecological/geological heritage of the soil, the local flora and the related agricultural practices informed and validated the research. A fluid process of discerning inspired by a constant dialogue with digital bio-experts, environmental activists³ and people native of the land helped the designer frame a design vision. Cross-pollination between diverse branches of knowledge – from natural science to art, digital technology and semiotics (Mangano, 2008) – enhanced the communicative language of the material instance. Designing for a specific context presents a series of constraints that narrow down the number of potential shapes the final design proposal could take. Constraints impose on the designer a degree of formal, technical, and material coherence consequential and consistent to the locality of the material context: to implement endemic practices of production into design practices becomes a natural dynamic and the environment can be effectively considered a design partner. This contextual approach has inspired the designer of Viral Nature to adapt the same material solution from 'one' to 'many' different localities, maintaining the indigenous nature of the resulting design.

To design locally means to generate transdimensional reactions to stimuli of various nature, relying on assets available in physical proximity. In the field of material design, this can translate into practices of (1) *material conversion*⁴, (2) *material transformation*⁵, or (3) *contextual material empowerment*⁶, which means respectively 1) to mechanically convert the purpose of matter, 2) to chemically alter the original state of matter, or 3) to allow the material to contextually express a plurality of potential purposes, decolonised by their stereotypical functional identity (Franklin & Till, 2018). The VN case study belongs to the third category.

VN is a material research, and design of a composite material able to host vegetal life, attract biodiversity and self-destruct, sustainably returning to the land. The main goal of the VN material research was to produce a compound hospitable to vegetal life, with a versatile material potential. The narrative proposed, along with the material design, envisioned VN objects integrated into biologically degraded landscapes Fig. 1 working as environmental healing agents (Pollini, B., & Rognoli, V., 2021) by empowering ecosystem resource cycles (Oxman, 2021).

3

While framing the design intention of the project, the designer approached activists who perform what is called 'guerrilla gardening', namely the action of gardening pieces of land that could not be cultivated. 'Guerrilla Gardening', retrieved on May 6, 2022, from: <http://www.guerrillagardening.org/>

4

Example of material conversion: "Totomoxtle", Fernando Laposse, 2019. Retrieved on February 14, 2022, from: <https://www.fernandolaposse.com/projects/totomoxtle/>.

5

Example of material transformation: "Dross", Bidasaria, 2020. Designboom, retrieved on February 14, 2022, from: <https://www.designboom.com/design/dross-project-furniture-formed-metallurgical-waste-materials-07-27-2020/>.

6

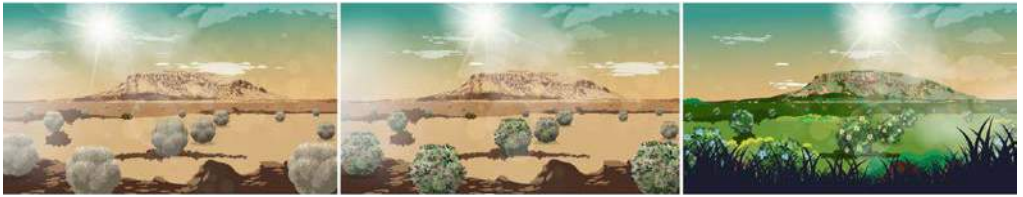
Examples of contextual material empowerment: "Viral Nature" project, 2019. Retrieved on February 14, 2022, from: <https://martinataranto.com/Viral-Nature-a-bio-synthetic-material/>, "An object archive", Lia Raquel Macques, retrieved on February 14, 2022, from: <https://liaraquelmarques.com/An-Object-Archive>.

7

The concept of "Primary ecological succession" is defined on Britannica, retrieved on February 14, 2022, from: <https://www.britannica.com/science/ecological-succession#/media/1/178264/125658>.

8

The definition of "Pioneer plants" is described at the page dedicated to the "Primary ecological succession" on Britannica, retrieved on February 14, 2022, from: <https://www.britannica.com/science/ecological-succession#/media/1/178264/125658>



Viral Nature Material and Potential Applications

The VN material is composed of a mix of natural fibres, plants and/or flower seeds, and a stone-based binder. The mix is designed to adapt to the diversity of localities, to geography, geology, weather conditions, and biodiversity, but also the designer's proximity to material assets. The material research originally aimed to address the issue of soil degradation and desertification in the south of Italy (Michelangeli et al., 2022; Ferreira et al., 2021). The project relied on the material's bio-receptive properties (Pollini & Rognoli, 2021) to intervene in a disrupted ecosystem by installing 'Eco Viruses' (EV). EVs are unit elements Fig. 2, made of the VN material, potentially able to trigger a primary ecological succession⁷ in desertified contexts.

Fig. 1
Illustrations of the conceptual evolution of the Eco-Viruses implanted inland. Chronologically from left to right. Screenshots extracted from "Viral Nature - The Eco-Virus" video on Vimeo.



Fig. 2
(Left) Close up picture of the EV; (Right) Eco-Virus sample sprouting while breaking its body structure.

The 'Eco Viruses' have icosahedral shapes; their aesthetic is inspired by the geometry of common viruses and also chosen for its functional reliability in structural stability on uneven surfaces (like those of rough fields) (Pawlyn, 2016): the concept of the eco-virus (antecedent to the pandemic) wanted to convey the idea of a highly contagious benign intervention on pauperised land. Self-sufficient vegetative units are to be disseminated on fields according to need in order to autonomously grow vegetation to spread it in the surroundings, and consequentially rejuvenate the soil. The VN mix is equipped with seeds of so-called '*pioneer plants*', organisms able to grow in extreme environmental conditions and to spread through the action of wind. Pioneer plants⁸ don't rely on pollinators to proliferate, but they are pollinator-attracting plants.

From pollinators to mosses and earthworms, VN structures are semi-extrinsic bioreceptive objects⁹ that can be colonised and colonise their habitat (Pollini and Rognoli, 2021; Guillitte, 1995) evolving, transforming and decaying according to nature's life cycles.

The VN compound can be shaped through moulding into the appearance of sculptural botanical objects Fig. 3. This feature allowed the designer to explore alternative material adaptations, in particular in the field of *material experience* (Karana et al., 2015 a; Pedgley et al., 2021). The designer and the biology of the artefact concur in defining not only the shape, but also the identity of the augmented/living object (Collet, 2013). To fully express its potential transversally, it is crucial to pay attention to the experiential qualities of the material in order to understand the socio-cultural meaning it can be charged with when received by the public (Karana et al., 2015 a).



Designing the Material

The aim of the material research was to obtain a composite material able to support and sustain vegetal life, eventually self-destructing symbiotically with the plants and the land. VN was born out of a happy accident from material experimentation developed in response to the process of *designing through making*. The design process was conducted exclusively through a DIY approach (Rognoli et al., 2015), relying only on proximal resources. After the observation of the unexpected result, a material investigation was initiated following what Karana and colleagues defined as a Material Driven Design Method (MDD), combining material experimentation with *design for material experiences* (Karana, et al., 2015 b). The design of the VN composite was facilitated by the support of a biohacker who experimented on the material to test how it could suffer or benefit from different external conditions. The design choices were regularly submitted for academic approval to meet certain design standards of quality and discussed with a naturalist for scientific assistance. The material studies were also supported by literature review, thanks to desk research on academic databases (e.g. Researchgate, Google Scholar, Scopus), online design platforms (e.g. Dezeen, Domus), and physical exhibitions (e.g., *Broken Nature*, Triennale di Milano, 2019, curated by Paola Antonelli).

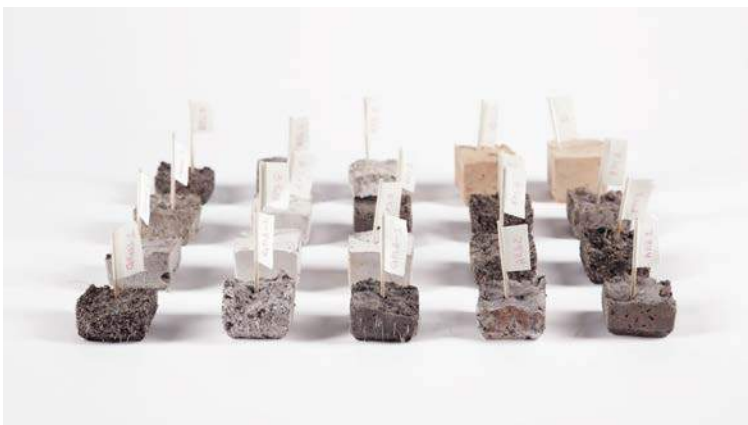
9

Guillitte defines a bioreceptivity scale identifying three colonization categories: "intrinsic" to the material, "extrinsic" if due to the presence of agents external to the material, "semi-extrinsic" if concurrently due to the characteristics of the material and to accumulation of external media.

Fig. 3
(Left) NumberFourteen, sculptural adaptation of Viral Nature, in its original stage, just extracted from the mould (Beginning of May 2021); (Right) NumberFourteen during the exhibition (End of May 2021), showing clear signs of reactivity to the season.

Soil degradation and desertification are issues that interest many geographic locations, thus one of the main goals of this research was to find a composition of the mix that could adapt to the diversity of localities, the availability of material means and the kind of intervention needed. This approach was also a necessary expedient since the designer was conducting the material experimentation dislocated from the addressed geographical context and had to allow biological flexibility to the biomaterial in order to be eloquent in different latitudes. In fact, on the basis of the performances expected by the material, a formula of a reprogrammable matrix was devised – a material algorithm that could help with the selection of the material components according to locality. The formula of the matrix was devised to ensure the healthy growth and livelihood of the embedded seeds. In total, 45 material samples Fig. 4 were developed and observed in their behavioural responses to recursive exposure to methodic watering, to constant monitoring of humidity and light exposure, in a set time frame of approximately 3 weeks. After identifying the right ingredients that make the VN mix valid in the context where the first design exercise was performed, the designer proceeded in classifying and defining the archetypical characteristics that the ingredients must have in order to fulfil each technical role within the mixture (e.g., to provide nutrients, to ensure moisture, make space for air, provide structure and brittleness at the same time, perishability, organicity...) in relation to the climatic and geological characteristics of the host environment. This exercise of classification, not only defines the profile of the required ingredients, but also provides: 1) a description of the macro and micro features that a potential material alternative should present, and 2) a method of tuning a material medium with the hosting ecosystem through ecological strategies, when the need of geographical translation of the material employment occurs.

The composite nature of the VN mix and its adaptability open to the possibility of discrete interventions and scalability, which in the field of biomaterials might translate into principles of genetics applied to material design, and therefore to the concept of 'Material Design Genetics'¹⁰ (Tang, et al., 2020).



10
In the addressed context, from 'one' to 'many', with the expression 'Material Design Genetics' is intended a practice of Material Design that is inspired by concepts and processes explicated by genetics. 'Material Design Genetics' is a practice of material design contaminated with and driven by biology.

Fig. 4
A selection of the Viral Nature material samples, displaying a visible variety of material combinations.

Results

Through the experiments conducted by the biohacker it has been verified that, under the favourable environmental condition, the VN material can sustain the natural life cycle of a pioneer plant and self-destruct in the process; on the basis of this attested biological compatibility (Camere et al., 2017) it is possible to imagine employing this material into innovative agricultural practices or as a mean to boost the presence of vegetation in urban spaces. The findings obtained through the VN material study are not exclusively related to the technical performance of the material, but relevant observations could also be gathered on an experiential and emotional dimension of design. Between 2019 and the present day, six sculptural adaptations of the VN material, with diverse but similar semantic and semiotic meanings, have been designed and exposed to the public audience through installations and gallery exhibitions around Europe Fig. 5. The public showcase of VN pieces, in the context of the pandemic, has allowed detecting of an enhanced cross-species empathetic response derived from physical (but also non-physical)¹¹ interaction with the living critter (Haraway, 2016) compared to the reactions observed in pre-pandemic situations. Similar to what was observed during the 'in lab' phase of the material study, VN objects (particularly in the blooming stage) stimulate inter-specie physical interaction and, with humans, instinctive emotional attachment, not rarely evolving into a mutual relationship of care. The self-destructive property of the material encourages a dialogue on the life expectancy of products and architecture and the concept of design for oblivion¹². Without opportunities and resources to further develop the technical properties of the material, the designer has driven the project toward a direction that explores experiential and narrative potential.



11
Viral Nature artefacts have been exhibited during the pandemic on online platforms and galleries, like Economia festival and DDW 2020. Retrieved on May 6, from: <https://www.youtube.com/watch?v=O-jL4vF4ciC0>; <https://ddw.nl/en/virtual-tours/11/the-new-intimacy-tour>

12
The concept of Design for Oblivion was introduced in the article of "Domus" dedicated to the VN project. Retrieved on February 18, 2022, from: <https://www.domusweb.it/en/architecture/gallery/2020/03/16/martina-taranto-design-has-the-right-to-oblivion.html>.

Fig. 5
TogetherTwentyTwenty, one of the Viral Nature sculptural application, exhibited at de Bijenkorf (Amsterdam) in February 2020. (Left) Picture taken at the beginning of the exhibition; (Right) Picture taken at the end of the exhibition, after approximately three weeks.

Conclusions

This paper analysed the design process of a bioreceptive semi-extrinsic material compound able to live and positively intervene in the ecosystem in which it is implanted. The material compound was developed through a DIY-Materials approach. The research aimed to investigate the material potential of the VN mix through an MDD experience, designing for local variables through proximal resources. The contextual practice of material design requires designers to eclectically adapt to the circumstances dictated by the material and its native locality. The VN case study shows that it is possible to produce material design strategies specific to one context while remaining generally valid and adaptable to multiple ecosystems. VN artefacts, have, in fact, been grown in different latitudes remaining identifying of the location and fundamentally endemic of the host ecosystem. The concept of a matrix, to be used as a material design algorithm, generates a material design effort resistant to the constraints innate within the practice of endemic design, and committed towards optimising material opportunities in different local remotenesses. The case study analysed in this paper showcases how endemic design strategies can be scaled up, generating multiple design responses with diverse phenotypical characteristics distinctive of different and specific locations. Every VN endemic version for existing requires an interactive network of material design practices, indigenous ecological knowledge and cultural narratives to sync. In the practice of design resistance, never to resist change.

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How Should Technology Follower Companies of Developing Countries Innovate Through Design Capability?

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Abstract

Design capability and design management have been recognized as critical tools for innovation. Reviewing the significant themes in design capability and innovation, the *Design Capability Model for Innovation* has been put forward in 2022. This article explores the design capability of a technology follower company through the innovation process of a condensing boiler design by referring to this model. The company and the design process have been undertaken as a revelatory single case study stating causal explanations based on the theories. Design capability development of technology follower companies depends on their technological development path and business strategies that they follow in Global Value Chains (GVCs). Focusing on technology follower companies, this article provides a unique insight into the crucial role of design capability and design management in achieving design-driven innovation and also expands the perspective of business practices and academic research.

Keywords

Design capability
Design management
Industrial design
Innovation
Technology follower companies

Introduction and Background

Over the past two decades, the economy's shift toward knowledge-based has played a significant role in recognizing design as a core innovation activity in business practices, academic research, and economic growth policies (Galindo-Rueda & Millot, 2015). Accordingly, Oslo Manual 2018 accepts "most design activities as innovation activities" (OECD/Eurostat 2018, 243). Oslo Manual 2018 defines design as a *business capability* comprising of three elements; *industrial design* that creates the shape, colour, or pattern of objects, the interface between software and users; *engineering design* which is responsible for technical specifications, tooling up, and prototype construction; and *design thinking* which is a systematic methodology for approaching the design of a product, service or system (OECD/Eurostat 2018, p. 119). A counterpart to the design process in manufacturing companies, design thinking methodology enables to triggering of new ideas and frames around existing problems and embraces identifying needs, generating ideas, selecting ideas, prototyping, and testing stages (Brown, 2008).

Design capability needs to be integrated into organizations at higher levels (such as strategic level) to achieve successful innovations. Hence, Oslo Manual 2018 offers companies to use the Danish Design Ladder. The strategic level of design can also be defined as design-driven innovation that leads to the economic growth of companies (Verganti, 2009). Although Oslo Manual 2018 put forward an invaluable framework for exploring the significant role of design in relation to innovation, it falls short of explaining the "meaning creation" and "communication" aspects of industrial design that were created during the design research phase.

On the other hand, design-driven innovation is defined as a networked research and meaning creation process in which designers, artists, suppliers, and universities interact with each other (Verganti, 2009). Aesthetic features of products reinforce brand values. Therefore, meaning creation can also rely on product design by which core brand values can be expressed. Accordingly, the lead products of a company can guide subsequent new product development (NPD) projects of other products in the brand portfolio (Karjalainen & Snelders, 2010).

Reviewing the literature on industrial design, design capability, and design-driven innovation, Tuncer Manzakoglu (2022) put forward a framework called "*Design Capability Model for Innovation*" to show the relationship between industrial design, engineering design, design thinking, and innovation (Fig. 1).

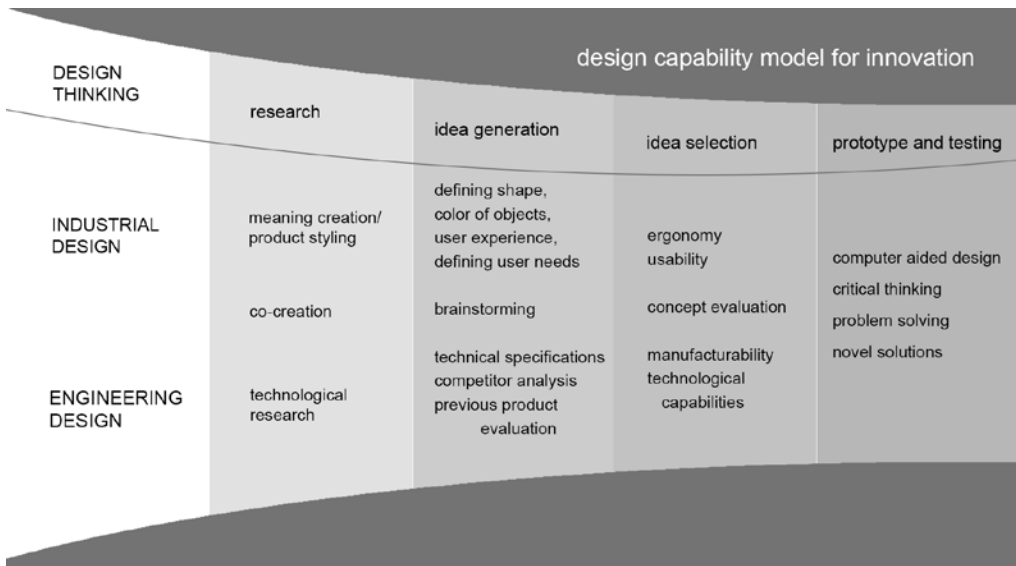


Fig. 1
Design capability model
for innovation (Tuncer
Manzakoğlu, 2022).

1
OEM: Original Equipment
Manufacturer, ODM:
Original Design Manu-
facturer, OBM: Original Brand
Manufacturer.

Focusing on *design capability* and its' strategic usage for *brand building* is crucial especially for technology follower companies to gain competitiveness in local and global markets. Because, based in a developing country, a technology-follower company is a late entrant into the industry, and its research and development (R&D) take place from outside the world innovation centers (Hobday, 1998). Therefore, technology-follower companies often miss out on building design capability due to their focus on advanced technological capabilities acquisition. Via R&D, a technological based is developed by technology-followers to facilitate an effective design leadership that results in the development of innovative products. In this article, the design capability of the case company is explained through the *Design Capability Model for Innovation*.

Additionally, *the integration level of design* into business represents a different trajectory in technology followers than the steps of the Danish Design Ladder. Because the development of design capability in technology-followers depends on their technological development path and business strategies that they follow in Global Value Chains (GVCs). As shown in *The Design Management Capability Framework in GVCs* (Fig. 2), OEM-ODM-OBM¹ are three business strategies in Global Value Chains that entail operational, functional, and strategic design management responsibilities, respectively (Tuncer Manzakoglu & Er, 2021).

This article represents a *revelatory case study* and mainly focuses on how a technology follower company (*Alarko-Carrier*) following ODM and OBM business strategies in Global Value Chains has exploited design capability for achieving innovation and supporting brand values. Within the case, the author as the *designer* of the company facilitates its' communication with the external network and develops a new frame for creating a consistent product portfolio. The embodiment of brand values in condensing boiler design (*SuperFit*) is strategically organized around boilers that can

be defined as lead products (Karjalainen & Snelders, 2010). The case study reveals that industrial design and design capability have a significant impact on the innovation performances of the technology follower companies because they import most of the core components from developed country companies; thus, they need to acquire design capabilities and design-driven approaches for creating value-added products and services.

Methodology

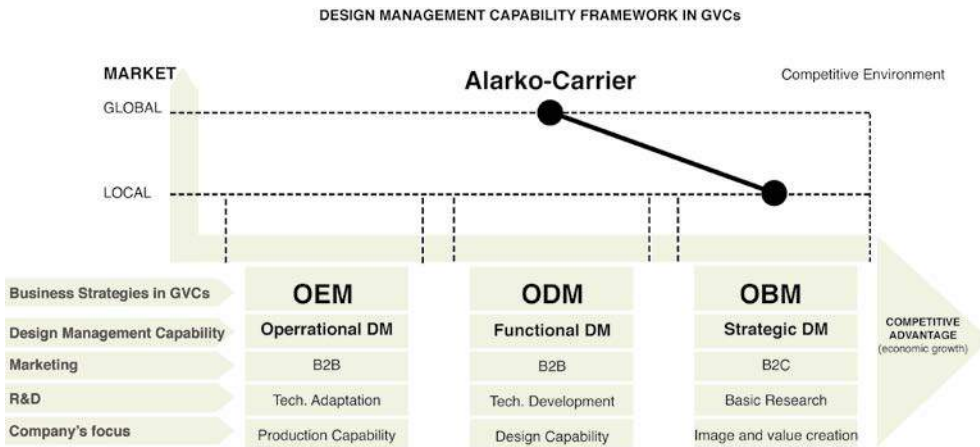
The case study method is suitable for gaining insight into real-life phenomena within a defined context such as individuals, groups, or firms (Yin, 2018). This paper particularly focuses on the role of design capability on the innovation capacities of technology follower companies operating in developing nations. While research on *Alarko-Carrier* is structured as a *revelatory case study* that provides access to a situation that was previously inaccessible and uncovers an interesting phenomenon (Yin 2018), it also put forward causal explanations based upon the theories of design capability, innovation and design management (see *Design Capability Model for Innovation* in Fig. 1, *The Design Management Capability Framework in GVCs* in Fig. 2).

This paper mainly focuses on the creation of the first product -*Super Fit*-, condensing boiler “*Fit*” series developed in *Alarko-Carrier*. The design project was initiated in June 2019, initial design alternatives were presented in August 2019, design development was accomplished according to the prototypes until February 2020, and the product was launched in April 2020. It has gained success in the local market and is still in production. The collaboration of the author with the company enables the acquisition of design and company documents, meeting records, e-mails, and participant observations. In addition to the multiple sources that enable triangulation of data, interviews were conducted with the Marketing Product Manager, Factory Manager CEO Assistant, and Heating R&D Manager.

The process of inquiry and the categorization of accumulated data were organized through a case study protocol (Yin 2018), which was developed according to the theoretical background. Since the focus of the study is to reveal the role of design capability in achieving innovation at the project level (operational level), two levels of design management responsibility were used as corporate and project levels in organizing the case study protocol (Oakley 1984). While open-ended questions were asked to the Marketing Product Manager and Factory Manager CEO Assistant to get information about the business and marketing strategies of the company, another interview was conducted with Heating R&D Manager to get more details about the design capabilities of *Alarko-Carrier*. The first interviews were conducted face-to-face in January 2020 during the boiler design project (lead products of the company) and the interview with Heating R&D Manager was organized on Zoom in June 2022, recorded, and fully transcribed. Finally, the case study report was sent to the interviewees for permission.

Design Management and Business Strategy

Alarko had been founded as a limited partnership to operate in the fields of heating, air-conditioning and cooling in 1954-Istanbul. In 1998, *Alarko* entered into a strategic joint venture with US-based *Carrier* (a global leader) for air-conditioning products (42% *Alarko*-42% *Carrier*-16% stock exchange market) (*Alarko History*, n.d.). *Alarko-Carrier* has been manufacturing and marketing its products under *Alarko*, *Carrier*, and *Toshiba* brands. *Alarko* brand has been positioned in local and regional markets for heating products such as condensing combi boilers, condensing boilers, burners, heat pumps, and radiators for which the company takes industrial design consultancy services to strengthen the brand. In export markets, *Alarko* follows a dual strategy; the first one is OBM which comprises export activities with its own brands in local and regional markets and the second one is ODM mainly being pursued in developed country markets where *Alarko* has limited penetration. In ODM activities, the company sells its' combi boiler and radiator products, designed and developed in-house, under the well-known brands of Germany, Sweden and Italy (Marketing Product Manager, personal interview, January 2020). Although *Alarko-Carrier* has a functional design management capability level, the institutional structure of the company provides flexibility and allows it to exploit strategic design management capabilities in local markets for developing its brands (Tuncer Manzakoğlu, 2022).



Alarko is a well-known brand name with 60 years of history in Turkey. In 1995, *Alarko* published the Pink Book that defines the business philosophy and organizational culture around the values of “trust”, “serve best quality products with reasonable price”, “protect nature”, “autonomous management”, and “emphasis on teamwork”. Therefore, *Alarko-Carrier*’s company values and documents have been investigated as a starting point for creating a new frame that enables a consistent design language for *Alarko* branded heating products. After analyzing the documents with the cross-functional team, key themes “robust, trust (for people, nature, each other), quality, modern and futuristic” were identified to be represented the brand values and guided the innovation process (Tuncer Manzakoğlu, 2022).

Fig. 2 Business strategies of *Alarko-Carrier* are shown on the Design Management Capability Framework in GVCs (Tuncer Manzakoğlu, 2022).

Design Capability: Employing Design Thinking Methods

In *Alarko-Carrier*, design capability comprises Heating R&D Manager, engineers, and technicians as in-house and industrial design consultants outsourced from the university. The condensing boiler project was initiated as a part of strengthening *Alarko* branded heating products in 2019, after the NPD process of boiler design in 2018 (Tuncer Manzakoğlu, 2022). Two significant triggers gave start to the project. The first one was to expand the condensing boiler product portfolio with an economy efficiency product. The second trigger was to respond to the demands coming from the European market toward developing a condensing boiler that can fit inside the kitchen closet (Heating R&D Manager, personal interview, January 2022).

In *Alarko-Carrier*, every project is defined and assessed in a project evaluation report. Within the case, *the product strategy was defined as creating a time-to-market condensing boiler product at a reasonable price with good design, quality, and user-friendly interface*. Although the usual innovation process of a new condensing boiler design takes one and a half or two-year time in the company, the new project was targeted to be completed in six months. Taking certain strategic decisions facilitated comprehension of the roles of engineers and industrial designer during the research phase.

Research

In design-driven innovation, the research phase has two main orientations as design and technology (Verganti, 2009). As mentioned in the boiler case (Tuncer Manzakoğlu, 2022), in a technology follower company, technology research is unfortunately limited to choosing the core components from global suppliers to set up the best configuration. In the condensing boiler design, the selected core components have been decided as the heat exchanger (Italy), a cooling fan (Italy), a gas throttling valve (Italy), a control card (Italy) and a pump (Germany) (Heating R&D Manager, personal interview, January 2022). A chassis, water pipes, gas pipes and other elements have been provided from local suppliers. As a result, industrial design and design capabilities emerge as the most value-added activities for differentiation and gaining competitiveness.

On the design research side, the industrial designer's previous project -boiler design- with the company serves as a reference point for what the brand stands for. Because, lead products can be used as a starting point in the subsequent NPD projects for other products in the brand portfolio (Karjalainen & Snelders, 2010). In understanding the company values, analysis of the *Alarko* logo has supported the document research. For example; double lines in the *Alarko* brand emphasize *durability* and *trust*, as the red circle in the logo stands for *flexibility* and *autonomy* within the certain frame of the company (Fig. 3). Finally, "*robust, trust (for people, nature, each other), quality, modern and futuristic*" has been defined as the key themes that can guide the design thinking process (Tuncer Manzakoğlu, 2022).



Fig. 3
Alarko brand's logo
(With the courtesy of
Alarko-Carrier).



Fig. 4
Boiler design as lead
product (With the cour-
tesy of Alarko-Carrier, the
manufacturer and brand
owner of the boilers).

Reflection of the themes and the brand identity has been expressed in the boiler designs positioned as lead products (Fig. 4). The certain cubic lines of the exterior sheet metal have been divided by an orange-yellow strip which also emphasizes the location of the panel and the themes of “trust, modern, and quality”. In the panel, the dominant design lines have been highlighted with red colour at the right picture in Fig. 4, which mainly stands for “modern, futuristic and robust” themes. Defined themes through brand identity and organizational culture, and how they represented in lead products were accepted as a reference point for the new condensing boiler design project. Therefore, technology and design research before the idea generation phase has been considered one of the most significant phases that provide input in an innovation process.

Idea Generation

At the idea generation phase, while industrial design focuses on defining shapes, colours, user needs and generating new user experiences, engineering design embraces developing technical specifications and evaluating competitors' products as shown in the *Design Capability Model for Innovation*. The selected heat exchanger allows the engineers to design condensing boilers with three different capacities such as 24-30-35 kW. Engineers in the Heating R&D Department develop and make 3D models of condensing boiler design mechanisms according to the selected alternative components to be imported from global suppliers. Market research on the competitors condensing boilers, such as; Bosch, Ferroli, and Baymak, indicated that a panel design positioned at the center of the product with minimal sizes is the most preferred design approach by users as well as the most cost-effective strategy from the producer side. Although this strategy limits creating the panel design alternatives, it has been selected due to its' ease of use and convenience with the initially defined product strategy.

Concept generation has been started considering the input coming from the research phase and the strategic decisions. According to Ulrich and Eppinger (2011), concept generation com-

prises 'idea generation' to represent a formulated design idea, also called 'product concept'. At this stage, the industrial designer mainly focuses on designing the panel and the front sheet cover of the condensing boiler. The material preference for the panel and the buttons was black shiny ABS plastic since it has become a trendy design approach in kitchen products and white goods. It also resembles the glass material used in the boiler's panel. The basic color in condensing boilers is white due to its compatibility with kitchens and preference as the most popular colour by users. Additionally, the panel and the front sheet cover decided to be manufactured with the moulding technique, which is very common in production.



Fig. 5
A few selected examples amongst condensing boiler concept design alternatives (Designer is Bilgen Tuncer M., with the courtesy of Alarko-Carrier).



Fig. 6
Two selected examples amongst condensing boiler panel design alternatives (Designer is Bilgen Tuncer M., with the courtesy of Alarko-Carrier).

Embracing the design language of the lead products and the key themes of “*robust, trust, quality, modern and futuristic*”, new condensing boiler design ideas have been formed as new product concepts (Fig. 5). Concept design alternatives have been presented in a meeting at the *Alarko-Carrier* factory.

Idea Selection

In the idea selection phase, a meeting was held to co-evaluate the product concept alternatives on the 21st of August 2019 with the internal stakeholders. The industrial designer has presented the design alternatives (Fig. 5 and Fig. 6) to the Factory Manager, Heating R&D Manager, and Production Manager. In evaluating the concepts, ergonomics, usability, and compatibility with the design guideline stand out on the industrial design side, while manufacturability and technological capabilities become significant on the engineering side. Ulrich and Eppinger (2011) also emphasize the impact of cost as a criterion in making decisions during the product concept selection phase.

Front sheet covers and panel designs have been considered one by one. For the front sheet cover, the plain and minimalistic design has been selected (middle picture in Fig. 1), as it is the most convenient design approach to represent “robust”, “modern”, and “trust” terms defined in the design guideline as well as it requires the most cost-effective and easy to accomplish manufacturing in six months-time without any defects. Among five concept design alternatives, the panel design (left picture in Fig. 6) has been selected for a user-friendly design and minimalistic features since it has more potential for creating a common design language among the product portfolio.

Concept product design drawings have been revised according to the decisions taken in the meeting. During the panel design revisions, the industrial designer has mainly focused on usability and ergonomic features of buttons and graphic designs through which user experiences have been created between machine and human.

Prototype and Testing

The prototype and testing phase comprises computer-aided design, critical thinking, problem-solving, and novel solutions. In October 2019, the industrial designer sent the revised and completed 3D model of the front sheet cover and the panel design to the engineers for producing a prototype. In November, the designer requested a revision regarding making all the front sheet cover radiuses at the same value to facilitate manufacturing. The designer rejected this request and did the necessary revisions for manufacturing by herself to keep the design proportions and meaning.

The well-defined product strategy, the know-how of the company in manufacturing condensing boilers for many years, and intimate collaboration in the design team have facilitated to proceed without having considerable problems in transferring the concept design into a produced product. In performance tests, engineers made fine-tune touches on the working mechanism.

During November and December, user interface design guidelines of the new product involving icons on the buttons, manometer graphic designs, model name and logo, typography, and RAL colors were generated by the industrial designer. The product strategy was to develop a compact condensing boiler that fit into a kitchen closet. Therefore, the industrial designer suggested using *Fit* as a model name which also represents a person who seems skinny meanwhile strong and muscled (has good performance). *Alarko-Carrier's* middle and high segment condensing boilers' models are “Seradens Super” and “Seradens Super Plus”, accordingly Marketing Product Manager completed the model name by adding “Super” to the “Fit”, and it becomes “SuperFit”.



Fig. 7
Manufactured condensing boiler design and its' advertisement (Industrial designer is Bilgen Tuncer M., manufacturer and the brand owner is Alarko-Carrier).

Co-creating a model name consistent with the product concept, strategy and its' meaning had a leading role in the brand management strategies. In April 2020, SuperFit's brochure and advertisements were launched on TV advertisements and social media in which a yoga instructor sits by the condensing boiler to better transfer the meaning of the product (fit, modern, simple, functional, and quality) to customers (Fig. 7). Consequently, SuperFit represents the brand value of *Alarko-Carrier*, while possessing its own product strategy with its aesthetic and functional features.

Conclusions

This paper explores the significant role of developing design capability in achieving innovation by improving products' "functionality/usability" and "aesthetics" with a particular focus on technology follower companies. Gaining competitiveness through design leadership requires developing design capabilities and a strategic level of design management. In exploring the design capabilities of the case company, the *Design Capability Model for Innovation* has been employed within the context of industrial design, engineering design, design thinking, and meaning creation through brand visualization.

In this context, the *Alarko-Carrier* case study contributes to the *Design Capability Model for Innovation* by emphasizing the communication and meaning creation aspect of industrial design, as it explains how condensing boilers have been developed around the lead products (boilers). This paper also contributes to business practices by revealing the role of industrial design and design capability in creating value-added products and how product range can be enhanced through a well-defined product strategy and brand values. The creation of a condensing boiler within the design thinking process –research, idea generation, idea selection, prototype and testing– explicitly put forward the significance of industrial design for achieving innovation and gaining competitiveness in the market.

The design thinking process of condensing boiler underlines how a technology follower company employs industrial design, engineering design, and design management for effective design leadership. SuperFit has been manufacturing since 2020 and gained a considerable market share in the local market with sales numbers of 29,000 units by 2021 and 10,000 units in the last five months. The success of the SuperFit led to the emergence of a new condensing boiler with digitalized features, which is positioned as high-segment in the market and resulted in the *Fit* series.

Additionally, design management development trajectories of technology follower companies are different from those developed country companies (Manzakoğlu & Er, 2018). Therefore, the *Design Management Capability Framework in GVCs* is employed to indicate the design management levels of *Alarko-Carrier* in line with its business strategies being pursued in Global Value Chains. Although the company seems to have a functional design management level, it exploits a strategic level of design management to support its *Alarko* brand in the local market through design-oriented product strategies. The strategic level of design in the company is exploited through design-driven approaches during the innovation process.

In a nutshell, this paper incorporates design capability and design management theories with the business practices of a technology-follower company within the context of innovation. Other technology follower companies, who import most of the core components of their products, can benefit from this study in terms of comprehending the significance of developing design leadership to gain competitiveness; on the other hand, researchers may contribute to the design capability and design management models in further studies.

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Subjectivation and Cities: Relationships between Local Independent Fashion and Possible Future Scenarios

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Abstract

This work is dedicated to studying the movement/collaborative network *Somos MAG* in south Brazil as an expression of the contemporary trend of collaborative networks in local independent fashion, but also as a space of immanence of noises that serve to think and possible future scenarios for different agents and areas, directly involved in local creative economies. Such factors are manifested in territories such as cities or regions, and they are increasingly integrated into a global economic and cultural dynamic, guiding creative proposals in values of localism and proximity. Through an interdisciplinary methodological arrangement, the study will present the operation of principles that relate Comprehensive Sociology, Interpretive Anthropology, Dialogism, Strategic Design and Foresight, with a view to identifying elements that allow the constitution of Possible Future Scenarios.

Keywords

Local independent fashion
Possible future scenarios
Collaborative networks
Localism

Introduction

The acts of imagining and living the city are multiple. They are associated with a polyphony (Canevacci, 1997) that is made clearer by the intense narrative in the dimension of communication and the narrative about them, at the same time that it leaves the limits more tenuous. This perspective, however, has earlier roots. At the beginning of Christianity, the idea of the city contained two conceptions: that of the city of God and that of the city of man (Sennett, 2018). The author himself defends that the old meaning be rescued, as it embodies a fundamental distinction. On the other hand, complexification designs many cities that do not offer everyone the same thing, but offer something to everyone (Sarlo, 2014). And it is at this intersection that models and their scales are defined, even if they have become deposits of the problems caused by globalization (Bauman, 2009). "It is in places, and thanks to places, that desires develop, take shape, fueled by the hope of being fulfilled, and are at risk of disappointment. (Bauman, 2009, p.35)

As a result, intangible elements such as sustainability, personalization, appreciation of local labor and collaborative networks guide the behavior of several social segments, willing to pay for the symbolic value of products and services permeated by these concepts (Castells, 2005; 2009). Such factors represent resistance to a scale model of mass production that has notoriously negative impacts on cities. The perspective, then, is to explore productive scales that present alternative ways, also allowing the definition of new relationships between objects, people and their experiences in the territories.

In the realm of fashion, this movement of resistance to the massive scale of production is something that has been taking shape for two decades. According to Susana Saulquin (2014), it is from the 1990s onwards that the "independent" value is established as a macro-social trend, activating manifestation fronts such as the transformation of thinking and designing fashion. In various parts of the world, designers and other individuals involved in creative areas sought to establish the basis for a leading role that also contributed to initiating another important movement: the decentralization of meaning-producing territories. Finally, the Global South came to be seen and recognized as a space for the generation of independent/authorial products, contributing to the recognition of cities outside the creative Eurocentric axis, such as Buenos Aires and, later, other capitals in Latin America (Saulquin, 2014).

This displacement of meanings and power was also accompanied by other important transformations regarding contemporary sociocultural contexts: changes in current consumption codes call for clothes that are more effective, stable and sustainable. These demands impact new consumption and also the logic of production of fashion artifacts. (Saulquin, 2014, p. 13). Added to this is the emergence of values that are having an incisive impact on the way people relate to the production of creative artefacts: localism and proximity (Maffesoli, 2012). When dimensioning localism and proximity as interrelated values to the desire for collectivity that unfolds today, we consider some dimensions of behavioral transformations that are being developed, especially with regard to the constitution of creative networks in decentralized territorial contexts.

These elements, allied to the inherent desire to collaborate (YUDICE, 2014), were the basis for the constitution of the movement/collaborative network *Eu Amo Moda Autoral Gaúcha* - or, simply, *Somos MAG*. The trigger that activated the constitution of this network is not only related to these aspects but is added to the global pandemic triggered by the Coronavirus. From this phenomenon, many events have developed, whether on a global or local scale. Thus, several people connected to fashion brands in the city of Porto Alegre, and in the state of Rio Grande do Sul, sought to collectively face the negative events triggered. In these cases, especially looking for solutions for the networks of professionals, techniques and knowledge linked to Local Authorial Fashion brands, as we will present below.

The term *gaúcha* refers to the local identity of southern Brazil, which reflects a history of territorial and cultural exchanges involving natives (Guarani, Charrua and other cultures) and settlers (Portuguese and Spanish) along the border established with Argentina and Uruguay - a cultural matrix to which other exchanges with enslaved Africans and European immigrants were also added.

What is Somos MAG?

The Somos MAG collaborative movement/network has a recent history. By visiting the profile @somos.mag, on the social network Instagram, it is possible to verify that the first contents - three posts with excerpts from the movement's manifesto - date from 07/04/2020. From that date until the current period, many Local Authored Fashion brands became part of the network and several other developments also took place. Among these, there are citations to the movement in reports from regional newspapers, such as *Zero Hora* and *Correio do Povo*. Photographic editorials, both related to some commemorative dates, as well as to contemporary themes / agendas, were also produced. We highlight one that addressed the themes of diversity and inclusion through five women, each one representing an expression of the broad spectrum of these agendas/themes today.



Fig. 1
Screenshot taken by the authors from the address: <https://www.instagram.com/p/CRIBHqsgqrH>. Accessed on 09/25/2022.

In addition to these actions designed and developed by members of Somos MAG, the project/movement/collective/collaborative network promoted the first Independent Fashion Week of Rio Grande do Sul. Due to the Coronavirus Pandemic, the event took place in a fully digital way through the Institute of Digital Transformation channel on YouTube, between November 28 and December 05, 2020.

By bringing this case to this work, we seek to answer a simple question: in addition to facing the difficulties established by the Coronavirus Pandemic, how can we think of Future Scenarios for this network and that, at the same time, benefit agents that compose it and serve as basis to be replicated in creative networks in other territories? In this context, we could propose that these Scenarios were designed and elaborated from excerpts from the movement's own manifesto:

Fashion is a social instance (...). What we wear communicates what we believe (...). We can choose not to know who is involved in the production processes of what we use. But if we choose to get to know these people, their stories, the knowledge and techniques they are using, we will be valuing the human dimension that is manifested in every fashion object we buy and consume. (Available at <https://www.instagram.com/somos.mag>, accessed 9/25/2022)

Methodology and application

To seek answers to this question, we propose a combination of methodological principles from comprehensive sociology (Maffesoli, 1988; 2012), from interpretive anthropology (Geertz, 2008), from dialogism (Bakhtin, 2008) from Strategic Design (Reyes, 2016, Franzato et al., 2015; Verganti, 2012) aligned with Foresight principles (Rasquilha, 2015).

By putting into practice some principles from comprehensive sociology (Maffesoli, 1988), already seeking to apply elements of the announced methodology, we made successive approximations with some brands and designers/creatives that are part of Somos MAG. These approximations occurred primarily digitally, via social networks. Afterwards, direct approximations and information were established with the people/creators responsible for the identified brands. It is important to point out that the direct approximations occurred in this way, as the authors of this work are also integral (and active) members of Somos MAG.

This perspective is in line with what Maffesoli (1988) brings as the dynamics of observation and understanding of factors related to the object of study from the perspective of the Dionysian researcher - the one who goes to the field in a more open way, letting himself be affected by successive contacts with its object of investigation. In this way, when carrying out visits and observations of profiles on social networks of some brands that are part of Somos MAG, plus insights via informal conversations that took place both in person and through digital platforms, we noticed some repeated elements. These elements are both present in the discourse assumed by the designers/creators responsible for the brands, as well as in the images and videos presented in the brands' profiles on the social network Instagram.

In this sense, we first recover the emergence of localism as an inter-relational value and - the way of Bakhtin's Dialogism (2008), intersubjective and present in the constitution of contemporary movements and phenomena. Based on this, it is easier to understand some aspects identified in the observations and interactions with brands and designers/creators. Thus, we see that localism materializes, on the one hand, as proposals for reconnection with territorial contexts that characterize specific territories - real or imaginary. We have both brands that present this reconnection through visual elements inspired by/taken from urban environments - places in the city of Porto Alegre, more specifically - as well as representative elements of a specific region of the state. Let's see the images below:

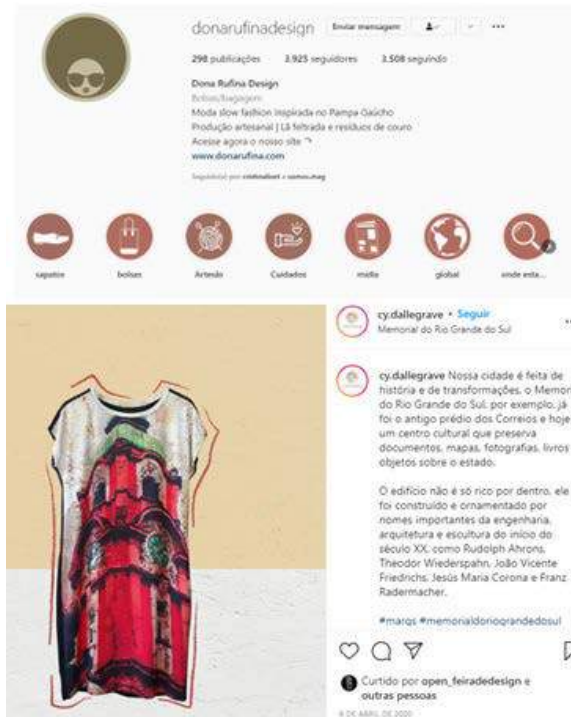


Fig. 2
Screenshots taken by the authors from the addresses <https://www.instagram.com/donarufinadesign> and <https://www.instagram.com/cy.dallegrove>. Accessed on 09/25/2022.

In the case of the Dona Rufina brand, localism is materialized through representative elements of the *Pampa Gaúcho*, a region whose particularities are both concrete aspects, in the case of the plain landscape characterized by a type of undergrowth, and subjective factors, such as a kind of melancholic and nostalgic emotion that was constituted from the observation of the landscape, also marked by the wide horizon free of obstacles to the look.

Here we are using a subjective perception of this territory in the way that Rancière (2011) suggests: sharing the sensitive from different codes present in literary works, music, paintings, and many other cultural and artistic expressions. In this case, this sharing refers to elements that refer to the territory of the Pampa Gaúcho. It is important to introduce this perspective, as it connects us to another constituent principle of the announced methodological

proposal: the webs of meanings present in different imaginaries, processes and productions, according to Geertz's (2008) interpretive anthropology.

The example corresponding to the brand Cy.Dallegrave establishes a direct relationship with aspects present in the urban territory of the city of Porto Alegre. These elements can be historic buildings – as in the image – as parts of monuments, museums, building walls, walls, lampposts and/or posters and stickers applied in different places. From the work with digital resources, these elements are transformed into prints applied on the surface of garments. The brand, which in its profile biography on the social network Instagram announces itself as “Clothes and objects with printed authorial art” ends up having its creative factor in this direct relationship with elements present in the city of Porto Alegre.

This same reference to elements present in the city of Porto Alegre is used as a differentiating factor for the Claudia Casaccia brand products, an enterprise named after the creative/designer responsible for designing accessories made of resin, and which is also part of the chain/ movement/project Somos MAG.



Fig. 3
Screenshot taken by the authors from the address: <https://www.instagram.com/claudiacasaccia>. Accessed on 09/25/2022.

An architect by training, Claudia Casaccia uses her technical knowledge to produce rings, pendants and necklaces inspired by iconic buildings in the city, such as Instituto Ling and the Iberê Camargo Museum.

In addition to this more direct relationship with some factors present and/or representative of territories in the state of Rio Grande do Sul, there are other aspects that are shared by different creatives/designers of the movement. In this case, we make use of another principle dear to comprehensive sociology: the identification of noise in the sociocultural environment as an indication of the new (Maffesoli, 1988); something that in the view of Verganti (2012) is called whispers present in the sociocultural environment. The identification of these elements, the noises or whispers, are fundamental for what we are trying to present here – that is, our proposal to relate Futures Scenarios to Foresight principles – as they are, in themselves, the bases for speculation and proposition of futures, whether

for this network and its agents, as for others that have connection factors to the case presented here. This perspective also combines Foresight principles with anticipating systems (Poli, 2015; Rasquilha, 2015), either to create Future Scenarios or to anticipate future visions - based, precisely, on the constitution of Scenarios - and can directly impact the territory where many of these elements and agents meet: the city of Porto Alegre and the state of Rio Grande do Sul.

From the Noises/Whispers identified to the Future Scenarios

In the book *Le temps revient* (2012), Maffesoli uses the metaphor of the climate to talk about perceiving the elements that form the spirit of time of a given period. He argues that the climate that characterizes our time is formed by many vapors, which is to say that there is not a single anima composing the current spirit of the time, but several.

This analogy finds reciprocity with the same author's view of what he calls noise, that is, something that is in dissonance with what is established as preponderant in the daily lives of the majority (Maffesoli, 1988). The idea, the thought, the gesture, the word, the individual habit that becomes the custom of a collectivity: these are some examples of the noise/climate relationship.

The terms are different, but the idea of dispersed whispers in the sociocultural environment that Verganti (2012) presents, intrinsically connected to the principles of Strategic Design, is equivalent to noise. In this context, identifying these weak signals enhances the strategic content of the project – this being an understanding of design that also encompasses the perspective of proposing solutions for the future (Celaschi, 2007, Verganti, 2012).

To exemplify some of the noises/whispers identified, we used the analysis of prints of profiles on the Instagram social network of the brands Claudia Casaccia, Doppia G and PretaCorBiju, and also the informal conversations we had with the creatives/ designers responsible for these brands:

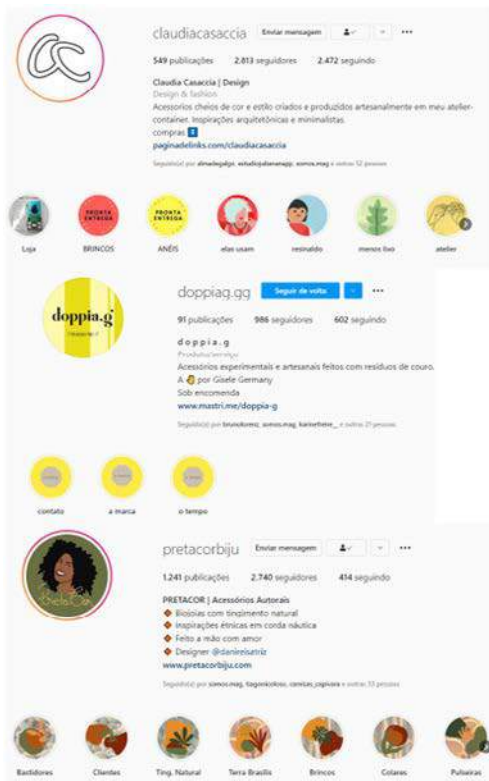


Fig. 4
Screenshots taken by the authors from the addresses <https://www.instagram.com/claudiacasaccia>, <https://www.instagram.com/doppia.g> and <https://www.instagram.com/pretacorbiju>. Accessed on 09/26/2022.

The noise/whisper observed/identified, whether in the profiles of the brands, or in conversations with creatives/designers, is the relevance of the time of manuality in the production of goods. This is particularly relevant with regard to the differentiation of offer and positioning, since it goes against, for example, the mass serial production that characterizes the Fast Fashion model on a global scale. The time of manuality as a discourse of differentiation and positioning of offer, brand and creative imagination also symbolizes aspects that touch processes, production scales and use of inputs. Here we have the identification of a value – in the sense of meaning, proposed by Geertz (2008) – which constitutes an intersubjective correspondence relationship between these brands and, logically, creatives/designers and the people/consumers of products, services and communication artifacts. of these ventures. The meaning that is produced from this value enhances alternative perspectives for Local Fashion, whether authorial or not. This also produces meaningful effects in the territories (Porto Alegre and Rio Grande Sul), since the Somos MAG network connects to other networks and agents, either in terms of constituting a discourse specific to Local Fashion, and/or to processes production, and/or marketing, and/or communication.

Thus, we have an interesting element to support the configuration of Future Scenarios that present alternative paths and opportunities.

About Possible Future Scenarios: principles, tool proposal and first elaborations

In order to interconnect Strategic Design principles with Foresight for the constitution of Futures Scenarios, we started this section by presenting the metaphor of the Cone of Futures, adapted by Joseph Voros (2003), to locate different types of futures: Preferable, Probable, Plausible and Possible:

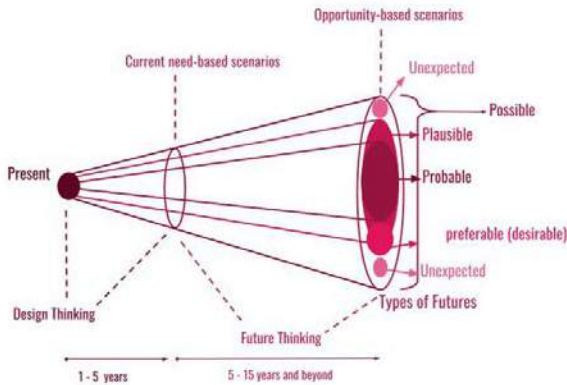


Fig. 5
Model adapted from Voros
(2003) by the authors.

This metaphor was brought after being adapted by the authors also to locate different elements as the Cone distances itself from the present and opens up to types of futures. Thus, we bring the relationship time x scenarios based on current needs and time x scenarios based on opportunities.

Probable Futures are the futures that we believe are most likely to occur, generally based on current trends, in many cases more quantitative. Plausible Futures are the ones we think could happen, especially given our understanding of how the world works today (laws of physics, social processes, norms, etc.). Preferred Futures, also known as Desirable Futures, are the class of futures that we think should happen. And finally, the Possible Futures are those that we think could happen, based on some future knowledge that we do not yet have, but that we may have someday (Voros, 2017).

Based on the metaphor of the Cone of Futures, we can infer that the Possible Futures are also characterized by an inherent uncertainty. In this sense, we find an interesting relationship between Foresight and Scenarios of Futures in the way of Strategic Design, since uncertainty is an element that serves as raw material, the relationship between anticipation and propositional thinking/action (Manzini & Jégou, 2003; Reyes, 2016; Rasquilha, 2015; Poli, 2014). This relationship also opens up possibilities to explore Opportunity-based Scenarios, contributing to the inherent learning exercise that anticipation work via Futures Scenarios provides. It helps in the conception of memories of the future (Rasquilha, 2015; Heijden, 2004), helping to project the future regardless of the scope where it is being thought.

This perspective is echoed in Poli's (2015) considerations for identifying the "future present". These are futures that can be known, seen and anticipated. These are futures that can contribute to shap-

ing the present, given that the exercise of Foresight implies a journey to the future, providing the present with the opportunity to develop strategies that make the future known and anticipated a reality.

In this sense, since the Scenarios of Futures in the way of Strategic Design are elaborated aiming to contemplate the elements Vision, Motivation and Proposal (Franzato, 2015), we could start our exercise of Possible Futures from the time value of manuality seeking to anticipate impacts on different areas that make up the daily relationships present in the territories of Porto Alegre and Rio Grande do Sul, and also in other territories. To this end, we propose the use of the Prisma STEEPH tool, which provides for cross and interdependent interaction between all the areas considered, establishing parameters for the practice of an integrative, simultaneous and circular thinking (Rasquilha, 2015), contributing to the design of complex scenarios.

Relating the elements identified in this work so far to the scopes of the STEEPH tool, we consider the following relationships:

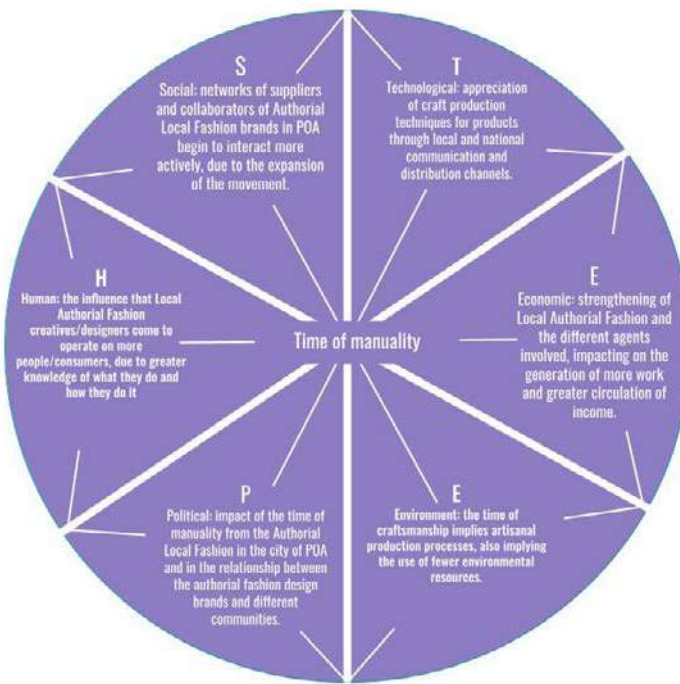


Fig. 6
Model adapted from
Rasquilha (2015) by the
authors.

From these relationships, we present the principles for the elaboration of Scenarios of Possible Futures, having as a guide a temporal dimension of 10 years.

Vision: Porto Alegre and Rio Grande do Sul as territories recognized globally for the actions to stimulate and spread local independent fashion, its authors and purposes.

Motivation: independent fashion can enhance the creation of creative networks that both promote territories and expand opportunities for work, income and development of knowledge (technical and non-technical) in a systemic way.

Proposal: from the elements listed using the STEEPH Tool, design Possible Future Scenarios for ten years ahead, seeking to anticipate possibilities involving different agents, scopes and organizations interrelated in the tool, in an interdependent and systemic way.

The elaboration of the Scenarios of Futures itself - the narrative of Scenarios that presents the development of the relationships presented - will be the subject of a new work. However, we understand that so far we have presented ways to illuminate other studies on the potentialities beyond those speculated, using both the principles discussed, as well as the analyses, interpretations and tools. Our intention was to propose another look at these relationships, especially latent and important at this time in the Global South. We understand that local independent fashion can be a way to activate alternative perspectives to those already established by the mainstream. Of course, this role can - and should! - be developed by other areas of Creative Industries and Economy in other territories.

Brief scenario narrative of possible and desirable futures

The year is 2033. The city of Porto Alegre is celebrating 261 years. Over the last 10 years, many transformations have taken place in the territory of Porto Alegre, many of which have been carried out by fashion design brands from Porto Alegre, which began to organize themselves as a large creative group based on articulations with public and private institutions. Another important transformation established by these actions concerns the understanding of the relationship production x scale of reproduction of artifacts. The time of manual work implies a smaller scale of production, implying the choice and conscious use of raw materials and energy. Although not all consumers of fashion design in Porto Alegre adhered to this behavior, the impacts of this posture of conscience when choosing and using goods echoed far beyond the city's own territory, it turns out that other entities - social and political - and, also, media, contributed to the dissemination of local authorial fashion design, its authors, imaginaries and motivations. In this sense, peer-to-peer (person-to-person) dissemination was fundamental, especially after the wide dissemination of creative and productive processes via digital networks, something intensified due to the advances of 5G and 6G Internet and developments regarding the metaverse. The speed of the connections ended up having an impact on the overvaluation of manual work time, placing local authorial fashion design even at the center of debates on knowledge preservation, self-care, well-being and the circular economy.

Conclusions

Scenarios are valuable tools to expand individual and/or collective perception, as they break limits of pre-established schemes and concepts, helping to transform culture, especially in organizations. This is due to the inherent competence of scenarios in terms of presenting unprecedented elements to the context, expanding the vision of

those involved in proposing the scenario (or scenarios) and, consequently, stimulating the rupture of institutionalized values, paradigms and customs (Van Der Heijden, 2004, pp. 99 – 105).

More than showing future possibilities for local authorial fashion design, the narrative of future scenarios serves as a basis for reflection on what we want/imagine when we think about anticipating actions, relationships and interactions between different social, cultural, political and cultural entities. In a systemic way from a sector/area that intrinsically already has relationships with other sectors/areas. Of course, we are presenting possible and desirable futures that are based on some latent factors mapped in the present - as we present from the Prisma STEEPH tool.

The very elaboration of the Scenarios of Futures - the narrative of Scenarios that presents the development of the relations presented - must be deepened in a new work. However, we understand that so far we have presented ways to illuminate other studies on potentialities beyond those speculated, using both the principles discussed and the analyses, interpretations and tools. Our intention was to propose another look at these relationships, especially latent and important at this moment in the Global South. We understand that local independent fashion can be a way to activate alternative perspectives to those already established by the mainstream. Of course, this role can – and should! - be developed by other areas of the Creative Industries and Economy in other territories.

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Track 5

New Education Pathways for Future Designers in a Changing World

There is a large consensus about the idea that the pandemic crisis is transforming almost everything for the next years or decades. The crisis will last longer than a few months and its behavioural and social implications could even be permanent, affecting the way we will produce and consume “knowledge” as a direct manifestation of our culture. These boundary conditions could represent the occasion to rethink about our own learning and education frameworks and methods to prepare future designers having a significant role and impact on the emerging challenges affecting organizations and the overall society. The track reflects upon two complementary perspectives. The first, how designers can apply their peculiar productive thinking to specific educational spheres (i.e. academies, universities, schools), but also to other organizations, to produce impactful changes related to cognitive processes and artifacts, moving into an environment where the field of education is going through significant disruptions from multiple points of view. The second, how a non-hegemonic approach to design education could introduce new perspectives on the future of experiences, opening to a more collaborative, inclusive, transdisciplinary and collective learning system. If knowledge has now to be considered at the same time a product, a service, a space, a time, this track invites researchers, practitioners, corporates, students and professionals in the field of education to share their experiences and studies on design-driven processes and related impactful projects on new formats and contents, technologies and interactions, local spaces in global geographies, processes and relationships for the ideation, production, distribution and regeneration of education. In general, the attention should not be addressed to emergency researches and practices arisen during the Pandemic period, but mostly to future focused practices.

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New Education Pathways for Future Designers in a Changing World

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Abstract

The article presents the results of the debate that emerged during the 8th *International Forum of Design as a Process*, organized in Bologna by the design units of three partner institutions: the University of Bologna, the Pontificia Universidad Católica de Chile and the Tecnológico de Monterrey (20-22 June 2022). In particular, the Authors were chairs of the New Education Pathways for Future Designers in a Changing World theme track. It focused on two complementary perspectives. First, how designers can apply their peculiar “productive thinking” to educational spheres or other forms of organizations; second, how a non-hegemonic approach to design education could introduce new perspectives on future experiences. After an introduction about the overall theoretical background, five themes have been created to frame the papers by international scholars. The conclusion outlines some elements that can be considered in a process of continuous research and discussion.

Keywords

Pluriverse education
Responsible knowledge
Collaborative learning system
Knowledge prosumers

Introduction

There is a large consensus about the idea that the pandemic crisis that affected the Planet in the past years has transformed almost everything with impacts for the next years or decades. The crisis is lasting, and its behavioral and social implications could even be permanent, transforming the way we will produce and consume “knowledge” as a direct manifestation of our culture. These exceptional conditions represented the occasion to rethink about our own learning and education frameworks and methods to prepare future designers having a significant role and impact on the emerging challenges transforming organizations and the overall society (Meyer & Norman, 2020).

Starting from these assumptions, the Track New Education Pathways for Future Designers in a Changing World reflected upon two complementary perspectives. The first, how designers can apply their peculiar “productive thinking” (Celaschi et al., 2020) to specific educational spheres (i.e., academies, universities, schools), but also to other forms of organizations, to produce impactful changes related to cognitive processes and artifacts. The second, how a non-hegemonic approach to design education could introduce new perspectives on future experiences, opening to a more collaborative, inclusive, transdisciplinary and collective learning system (Escobar, 2018; Bosco, Gasparotto & Formia, 2021; Boehnert, Sinclair & Dewberry, 2022; Noel, 2022; Formia, Gianfrate & Succini, 2023).

If knowledge has now to be considered at the same time a product, a service, a space, a time, the Track hosted researchers, practitioners, students and professionals who shared experiences and studies on design-driven processes and related impactful projects on new formats and contents, technologies and interactions, local spaces in global geographies, for the ideation, production, distribution and regeneration of education (Salamanca, Mercer & Briggs, 2019; Succini et al., 2021).

In general, the attention has overpassed the practices arisen during the pandemic period being mostly interested to explore future-focused research and processes. The selected essays answered the call of *8th International Forum of Design as a Process's Track* in creative ways. This led to the publication of 24 papers, by 59 Authors, coming from 10 countries. In particular, the involved institutions and organizations are: Federal University of Pernambuco State, Universidade Federal de Mato Grosso, and UNISINOS (Brazil); Langara College (Canada); Pontificia Universidad Católica de Chile (Chile); Pontificia Universidad Javeriana, Cali (Colombia); Université Côte d'Azur (France); Codesign Toscana ETS, Iuav University of Venice, Politecnico di Milano, Politecnico di Torino, Sapienza University of Rome, and University of Bologna (Italy); Rzeszow University of Technology (Poland); Polytechnic Institute of Portalegre and University of Aveiro (Portugal); University of Borås (Sweden); University of Applied Sciences & Art Northwestern Switzerland (Switzerland).

To provide for a general overview of the main topics collected in this part of the volume, we started from the word “E.D.U.C.A.T.E”, whose anagram contains the key concepts identifying the stream presented below: Empower, Diversity, User-Centricity, Creativity, Ambition, Transition, Ethics. Each of these keywords has been set in

relation to the others, arriving at the identification of commonalities between the Track contributions, resulting in five main themes. Below, we briefly summarize them, point to fruitful moments of connection, and thereafter highlight opportunities for future development.

Theme 1: Design Ethics and Enabling Education for Emerging Challenges

The first topic is related to Design Ethics and Enabling Education for Emerging Challenges. It focuses on the role of design to get the right “posture” towards wicked problems, such as decolonization, social coexistence, democratic participation, student-centered education, employment perspective. The Authors address design-driven models, experiences, and projects developed in academic environments, but also linked to non-institutional contexts and implemented in local communities.

Starting from the case of Langara College when the Author has been asked to lead a new course called *Decolonizing the Design Process* — which reflects Canada’s nationwide trend toward Indigenization of educational frameworks —, Scot Geib (*Decolonizing the Design Process: A Case Study In Authorship, Power, and Control*) explores opportunities and obstacles related to a shift in education models with a focus on Western paradigm disruption. The theme of democratization emerged also in the paper by Valentina Facchetti, Laura Galluzzo, and Ambra Borin (*OpenMind Handbook. A system of design tools and processes to empower democracy culture in primary schools*) that investigates the role of Service Design in activating participatory processes that can foster the co-creation of educational experiences aimed at raising awareness of social coexistence. On the other side, Sasha Londoño-Venegas and Adriana Jaramillo Botero (*Architecture, design and community in Colombia. More Urban, more Rural, more Social: the workshop experience*) focus on the multiple roles of knowledge that calls researchers, teachers and academics to share experiences and studies on small-scale impact projects related to non-conventional formats. In the context like Colombia, which is described as case study, with high rates of neglect of vulnerable sectors such as school-age children, the paper points out the social responsibility of the academia to work on knowledge innovation in terms of formats, contents, practices and methodologies.

Practices for enabling students towards their future opportunities are described in the paper by Lara Maria Luft, Debora Barauna, and Gustavo Severo de Borba (*Creative Community for Generation Z teachers in Brazil through Strategic Design*). It explores the reasons behind the observed lack of engagement among young individuals in pursuing teaching as an appealing professional path. According to the Authors, to overcome the perceived lack of interest among GenZ, design can play a significant role in addressing this issue by fostering the creation of creative communities that enhance connection among members and encourage collaboration (such as the *CoNU-Midade Turbo experience* mentioned in the paper as case study). Finally, Clio Dosi, Eric Guerci, Jacek Jakięta, Joanna Świątoniowska,

Eleni Vordou, Maria José Varadinov, Matteo Vignoli, Gastão de Jesus Marques, and Joanna Wójcik (*Design Thinking and Career Development: A Comparative Study*) highlight the importance of career awareness for university students and the related social responsibility of universities to guide them through the process of choice driven by employability criteria and a counseling approach.

Theme 2: Innovation, Creativity, and Diversity to Lever Collective Intelligence and Inclusion in Complex Environments

The second topic is related to Innovation, Creativity, and Diversity to Lever Collective Intelligence and Inclusion in Complex Environments. It reflects on the role of design to value diversity and inclusion (Costanza-Chock, 2020), hybridizing learning paths by culture and creativity as catalysts for innovation. The first group of papers is strongly connected to the dimension of private organizations such as companies, investigating design-driven innovation perspectives as form for disrupting canonical processes towards a more inclusive and creative vision. Progressively the attention moves towards eco-systems that include wider groups of stakeholders such as universities, creative and cultural industries, local actors, and communities. Finally, the last group of papers reflect methodologically upon the agency of creativity in complex innovation environment.

Isabela Moroni and Amilton Arruda (*Design Processes: from the historical perspective to the application in startups companies*) underline the role of innovation in maintaining an organization's competitive capacity. This dynamic is fundamental for the construction of the central competence of a company which is the ability to generate knowledge. A five-step process is described for this purpose. By presenting the Electrolux case, Marco Limani (*Design and innovation: where do we want to play? Inquiry into some design's strengths and weaknesses in innovation*) discusses the role of design education compared to managers educated in design. According to the Author, fundamental barriers exist to successfully overtaking and legitimizing design in innovation processes. This is because the discourse cannot be siloed among design, business, management, marketing or technology; world complexity requires a holistic approach and the support of each discipline's vertical and horizontal capability to increase the innovation likelihood of success.

Starting from the case of *Design Ecosystem* in Portugal, Marlene Ribeiro and Francisco Providência (*Design ecosystem in Portugal. Education, research and entrepreneurship*) investigate the role of design in creating new problems, activating change in consumption habits and organizational evolution. In this light, the research tries to identify possible causes for the still fragile connection between design and industries and to point out alternatives for a more effective collaboration. In a similar perspective, Rita Duina, Marco Berni, and Andrea Del Bono (*The design posture: a collaborative learning-by-doing approach*) present the perspective of *Codesign Toscana Project* on the idea of "design posture", which emerges as a multifaceted concept with a different nuance when discussed by "experts" or "practitioners". According to the workshop

series described in the paper, experts adopt a self-reflexive attitude towards their personal and professional life as designers for communities; practitioners are more oriented in conceiving the concept as a “mood” towards the community they work or live in and as a widespread sense of agentivity among people involved in design processes. The research also tries to formalize “design posture” both theoretically and in practice to trigger a series of active citizenship dynamics that can facilitate the multiplication of spaces for inclusion and empowerment. Moving towards a more specific sector, Daria Casciani (*Advanced Manufacturing for Sustainable Fashion. Developing interdisciplinary educational experiences*) investigates the fashion industry as a creative industry with high cultural, social, and environmental impacts, demanding a paradigmatic shift through digital transformation toward a sustainable change. Starting from the lessons learned from the *Advanced Manufacturing for Sustainable Fashion* (ASMF) module conducted at Politecnico di Milano (Design School) in the course Design for the Fashion System, the paper states how fashion education needs to nurture professionals who can tackle increasingly complex challenges, dive into technological systems. Davide Fassi and Francesco Vergani (*Co-designing contents with situated stakeholders: an in-field process in Nolo – Milan*) describe OCN – *Open Campus Nolo*, a living lab promoted by Politecnico di Milano: a multi-purpose format that proved to be suitable for binding research, teaching, and action together, providing methodological principles that could be scaled and replicated in local environments. This context emerges as “design incubator” characterized by the proactivity of local actors - such as citizens, shopkeepers, associations, informal groups -, acting at the core of the design process by developing brand-new and tailor-made solutions, and, at the same time, providing environmental, economic, and social beneficial transformation in an inclusive and democratic way.

Starting from the case of *NUBE Lab Project*, Alejandra Amenábar Álamos (*Creativity and Mirror Effect. Teaching creative skills through non-traditional pedagogies*) aims to indicate creativity and innovation as future engines of the global knowledge economy. In this scenario, a consistent role is played by “design pedagogy” which is crucial for transferring project methodologies and fostering creative skills. However, the technological and social transformations of this century have challenged traditional educational canons and the very definition of creativity. The paper overcomes these challenges by analyzing non-traditional educational paradigms to address them from a design methodology perspective. Finally, Yuqing Zhu and Yunyu Ouyang (*How Design Thinking Could Benefit Future Educational Environments in a Post-Pandemic Era?*) reflect on the change of the learning environment pattern which has characterized the post-pandemic era. As an effort to better support the new traits, design thinking, especially the empathizing, redefining and prototyping strategies, could help in adapting to the new surroundings at three different scales: the family and neighborhood scale, the regional medium-scale learning experience, the international scale, where innovation could be focused on the creation of virtual platforms to grant equal access for learners from developing countries.

Theme 3: User-Evolution to Build New Knowledge Pathways

The third topic is related to User-Evolution to Build New Knowledge Pathways. It reflects on the role of design to build knowledge trajectories focusing on the continuously evolving user-perspective by exploring new topics and the impact of enabling technologies to create hybrid form of education.

Daphne Degiorgis, Marco D'Addario, Beatrice Lerma, and Doriana Dal Palù (*How a technology identity can enhance the diffusion of good design practices in Product Sound Design*) investigate Product Sound Design as a promising research field. The case study is a patented method-and-tool, conceived to collect, analyze, and recreate various sounds to develop a new generation of products with designed mechanical and, eventually, digital sounds. Spreading this innovation within the design community is fundamental to stimulate future more focused and aware practices and can be seen as an example of a way to “educate” the designer to future-focused themes and reconnect the technology to potential users.

Vittorio Linfante and Andrea Manciaracina (*Learning and teaching from and by social media. Instagram to support blended learning models*) investigate the effectiveness of social media, particularly Instagram, within a teaching activity. The assumption behind is that digital transformation drives new visualization, promotion and storytelling processes of the design system, defining new relationships between physical and virtual spaces in which users are not just spectators of the creative phases, but are increasingly involved in processes of “value co-creation” and “cooperative investment”. On the other side, the case study *Gamelon Pad*, developed within the research activities of the Open Design group, as part of the virtualLAB (Politecnico di Torino) activities, in collaboration with Fablab Torino, is described by Fabrizio Valpreda (*Education & Practice in Open Design. Improving the learning experience through knowledge connections*) as the occasion to test a new approach to a multidisciplinary design process, starting from the educational experience. The paper underlines a scenario where a student is put into conditions to experiment the entire design process, in order to develop a physical design solution for a user with disabilities.

Theme 4: Design for Transition

The fourth topic is related to Design for Transition. It reflects on the role of design to enable ecological, social and technological paradigm evolution (Irwin, Tonkinwise & Kossoff, 2022).

Angela Grosso Ciponte and Evelyne Roth (*You can never solve problems with the same mindset that created them. How can we change the how and the what we teach to enable our students to become truly «terrestrial» designers? A proposition following Bruno Latour's «Terrestrial Manifesto»*) describe a series of workshops where interdisciplinary teams of students, as well as lecturers, work in cooperation with enterprises on concrete cases to explore methodological approaches to circular design. Results validate the hypothesis that education can successfully work in an open process and collaboratively convey circularity. Transition has to be consid-

ered as a target of education at the university level, while companies in transition can operate sustainably in a circular way, even if the main economy does not yet follow this model. Starting with didactic design experimentations, Loredana Di Lucchio and Ivo Caruso (*Good for Good. Designing packaging in the era of deliveries*) point out the attention to process innovation as the result of a progressive loss of centrality of product design. Due to a deep change of scenario, in recent decades design as a discipline and practice has shifted its attention from the morphological and technological aspects of an object (both material or immaterial) to questions related to the interaction in between object and man (Human-Centred Design), in between object and environment (Design for Sustainability), in between object and object (Design for Interaction), in between object and society (Design for Social Innovation), to arrive to exclude the object from the innovation process (Design of Services) and to open to the broader field of systemic design. Leonardo Moiso, Sofia Cretaio, Cristina Marino, Chiara L. Remondino and Paolo Tamborini (*Onboarding future Systemic Innovation Designers through informal and collaborative activities*) highlight the importance of educational methodologies in shaping digital environments, with the designer's expertise playing a pivotal role. This methodological application is also explored in professional development programs or lifelong learning initiatives, where incorporating digital tools and educational methodologies improve individuals' skills in a rapidly changing digital landscape. Delia Dumitrescu and Martina Motta (*Material practices in transition: from analogue to digital in teaching textile and fashion design*) present case studies exemplifying diverse ways of approaching the teaching of material design in textiles and fashion field, wherein haptic knowledge is combined with digital media. The results of each case study are an example of the positive impact of a cross-disciplinary approach, and of the benefits of combining tools in a context shifting from Industry 4.0 to Industry 5.0. Starting from ARTERI'A Project in Vigolzone (Italy) municipality, Nour Zreika and Daniele Fanzini (*Designing for the Future of Education Through Cultural Heritage*) highlight the role of schools and the importance of cultural heritage education. The contribution points out the importance of informal education to be considered as a formal learning tool to be used in a new concept of school that becomes think tanks for designers, stakeholders, and policymakers.

Theme 5: Future-proof Scenarios and Perspectives

The fifth topic is related to Future-proof Scenarios and Perspectives. It reflects on the role of design to build, unbuild, rebuild new scenarios and narratives for the future, including different fields of application (Celaschi et al., 2019).

Suzanne E. Martin (*We Need to Talk About Learning Design. A Proposal for Critical Conversation*) underlines the need for a significant reorientation of design theory and practice to make this a transformative moment in history. According to the Author, design education has the responsibility to re-imagine learning and enable new ways of shaping pedagogical knowledge, finding ways to illuminate the words that visualize that future. Based on the emerging trend of

the “living publication scenarios”, Eleonora Lupo and Sara Radice (*Collaborative learning of Ph.D. candidates in Design on emerging scenarios in scientific publication*) show models and practices to disrupt traditional publication patterns and envision new formats beyond the canonical “article”. They point out how new typologies research products and new forms of dissemination meet the challenges of an impactful design education to empower PhD students. Finally, Liana Chiapinotto, Fernando Guimarães Horlle, Tássia Ruiz, and Celso Carnos Scaletsky (*Scenarios, networks and systems: an alternative to dichotomous patterns*) outline an alternative point of view on the way design teaches and thinks scenarios, beyond prospective methods that stimulate speculation by antagonisms. Network elements allow us to imagine the future and reflect on the past and present in a systemic way, with the density and specificity that are required from the design professional in problematic situations.

Discussion

Encompassing a variety of aspects regarding the connection between design and knowledge innovation, the previous compilation is far from being exhaustive. A series of “wicked problems” (Rittel & Webber, 1973) have not gone into detail in it. For instance, the rise of artificial intelligence, the urgent challenges for maintaining the Planet, the post-human perspective, the new hybrid-flexible forms of learning linked to enabling technologies, the “education gap”, the multidisciplinary contaminations, the growing of skills-centered education ask for new theoretical perspectives, as well as concrete design actions. Addressing our attention to such topics, considered as the contemporary condition of Transition Design (Irwin, 2015) Education, but also Transition Design in and for Education, could yield even more interesting results paving the way for further scholarly discussions.

The second aspect is related to the distance between design research and teaching, that needs to be considered because they “have always had a close (and difficult) relationship in most contemporary educational settings” (Jonesa et al., 2022). The submission received clearly demonstrates that processes of action design research are strictly linked to educational contexts, both inside and outside academia. This is true also if we consider a non-hegemonic approach that overpasses the dominant Western centric perspective.

Finally, the overall discussion opens to consider design education as a specific field of knowledge with all the complexity and contradiction that entails, but also to enlarge the perspective on design as a driver of new eco-systemic education which includes a huger set of contexts (private and public organizations, associations, institution, etc.) and a wider set of not-institutional and informal practices.

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Decolonizing the Design Process: A Case Study in Authorship, Power, and Control

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Abstract

While the concept of decolonization has long been an area of academic interest, it has more recently spilled over into mainstream discussion among designers, clients, and other cultural mediators. In Canada, this conversation has been amplified, in part, by the Truth and Reconciliation Commission (TRC), which has shed light on the destructive legacy of Canada's settler colonialism and its Residential School Program. What started as a curriculum development project in the Design Formation Program at Langara College, necessitated a case study in how to turn theory to practice, primarily by investigating the structural biases inherent in the Western traditions of design and exploring ways in which that design paradigm might be shifted.

Keywords

Decolonization
Design education
Collaborative learning system
Experiential design

Introduction: Truth and Reconciliation's Calls to Action. How, Then, to Decolonize?

While the concept of decolonization has long been an area of academic interest, it has more recently spilled over into mainstream conversations among designers, clients, and other cultural mediators. In Canada, this growing interest in decolonization has been amplified, in part, by the Truth and Reconciliation Commission (TRC), which has shed light on the destructive legacy of Canada's settler colonialism and its Residential School Program. Residential schools were instituted from around 1883–1997 by the Canadian Government as a covert act of the cultural genocide. More than 150,000 Indigenous children were forcefully removed from their homes and forced to attend “schools”, often far away from their homes, where they were not allowed to speak their language. While attending these “schools”, not only were Indigenous children exposed to physical, emotional, and sexual abuse, thousands of children died.

To date, the National Centre for Truth and Reconciliation has documented 4,118 children who died at residential schools, as part of its work to implement the TRC's Call to Action 72 to create a national death register and public-facing memorial register. Not all the deaths listed on the registry include burial records. (Deer, 2021).

After recording the testimony of more than 6,000 residential school survivors, the Truth and Reconciliation Commission responded to this legacy of abuse by writing ninety-four Calls to Action in 2015. TRC Call to Action Number 63 was for post-secondary institutions to integrate Indigenous knowledge and teaching methods in the classroom. “We call upon the Council of Ministers of Education, Canada to maintain an annual commitment to Aboriginal education issues, including: (iii) Building student capacity for intercultural understanding, empathy, and mutual respect” (Truth and Reconciliation Commission of Canada, 2015).

However, despite the subsequent and sincere assertions of design educators to decolonize their educational frameworks, there has been little consensus on what it means to actually *do* this work. The word *decolonization* is increasingly becoming not just a mandate, but also a buzzword, in Canadian institutions, specifically in post-secondary schools. Decolonization is often quoted, but articulated without clear referents or even clear definition. As a result, discussions about decolonization in Canada have run the risk of feeling performative, especially in the absence of measurable outcomes.

It is important not to mistake a discussion about decolonization, even if it is an intentioned and principled one, for the larger, more complex goal. Talking about decolonization is not the same as actual decolonization. The educational institutions that support these discussions have been born from colonial frameworks and still uphold many of these values. As Tuck and Yang write:

One trend we have noticed, with growing apprehension, is the ease with which the language of decolonization has been superficially adopted into education and other social sciences, supplanting prior ways of talking about social justice, critical methodologies, or approaches which decenter settler perspectives (Tuck & Yang, 2012, p. 2).

How, then, to avoid the dreaded “tokenized checklist response” (Pidgeon, 2016, p. 77) when creating a new education framework, while at the same time ensuring the integrity of design outcomes?

This question of “how” might feel particularly nebulous for educators who are called to decolonize their classrooms, but who might not come from Indigenous and/or academic backgrounds, and therefore might be less immersed in both the political and academic discourse. Similarly, in the professional setting, designers (and design mentors) are typically required to work under significant constraints of time and finances. Real change, however — the kind of meaningful, structural change that has been called for by the TRC — requires resources. While *decolonizing the design process* sounds like an exciting, well-founded, and timely proposition, it inherently presents logistical challenges, due to the inconsistency of how individuals might interpret the Calls to Action, the resources available to implement these calls, and the risk of falling into short cuts and lip service.

Despite these challenges, there are also opportunities, if one is willing to enter into unpredictable nature of a shifting paradigm, work with new processes, and allow oneself to not have to control every outcome. These opportunities happen to sound a lot the contemporary design process itself, with its built-in processes of creative problem solving and iterative thinking. But where “design thinking” hints at a pathway for decolonized thinking, the contemporary design process is based upon colonialist assumptions or power, authorship, and control. These concepts must be questioned and their mechanisms must be shifted.

As Paulette Regen, Director of Research for the TRC states (2006),

Decolonization is not “integration” or the token inclusion of Indigenous ceremony. Rather it involves a paradigm shift from a culture of denial to the making of space for Indigenous political philosophies and knowledge systems as they resurge, thereby shifting cultural perceptions and power relations in real ways.

Taking Regen’s proposition as a launching point, *decolonization of the design process* —whether in the classroom or in professional practice — must shift to a process of collaboration, instead of a process that denies of the perspectives of others. Such a paradigm shift should, ideally, not feel like a threat to the designer, but rather an opportunity for deeper creativity and more complex problems solving, which should already be among a designer’s core values.

Decolonizing the Design Process: An Invitation to Curriculum Development

In 2020, I was asked to lead the development of a new course at Langara College called *Decolonizing the Design Process*, which reflects Canada’s nationwide trend toward Indigenization of educational frameworks. This invitation was due to my professional history as an experiential designer who has extensive experience working with Indigenous and multicultural clients and stakeholders on numerous exhibit design projects in Canada, such as at Vancouver’s Museum

of Anthropology, Museum of Vancouver, Fort Calgary Historic Site, and the UNESCO-recognized Chung Collection. However, as a designer who comes from a white-settler background, not only was it paramount for me to collaborate with Indigenous knowledge keepers on curriculum development, it also represented an important first step in my exploration of decolonization itself, that is, giving up any claim on authorship, power, and control over the development and design of this new course.

Given the land upon which Langara College exists, the impact this course can and must be tangible. Accountability is built into the environment. Langara College is located within the traditional and unceded territory of the Musqueam Nation. The Musqueam people are a contemporary, vibrant, and living culture. In 2019, Langara was honoured to receive a name from Musqueam, in their hən̓q̓əmi̓nəm̓ language: snəw̓eyəṭ leləm̓, which means *house of teachings*. Langara College has already shown commitment to its relationship with its host Musqueam Nation by implementing the first formal Aboriginal Education Policy in British Columbia, (Langara College). In the development of this new design course, I have been fortunate to work with the Indigenous Curriculum Development Team at Langara College. This curriculum advisory team is more than consultative, but an essential voice in the process. And the cultural intersections do not end there. While Langara College is seated on Indigenous land, and is based on a European educational model, the majority of the student population comes from heritages that are neither Indigenous nor white-settler, namely Asian and Latin American cultures.

Shifting Paradigms and Processes: Shifting From Where to Where?

A paradigm shift is not a one-step, one-size fits all process. In order to know what we are shifting towards, we must understand what we are shifting away *from*. It is important to identify the mechanisms that perpetuate the pervasive colonialist models of design. The curriculum development for the *Decolonizing the Design Process* course has only begun and is far from complete. It is expected that the curriculum implementation will be an iterative process, one that will continue shift from year to year, until it is able to consistently meet course objectives, regardless of the specific instructor (Indigenous or settler) and the team of Indigenous co-educators that will be crucial in delivering course content.

Just as settler colonialism has existed for centuries and continues today, decolonization is also the work of multiple lifetimes. In the context of a single course, decolonization cannot be completed in a single iteration: It is a process, not a product (Attas, 2019, p. 128).

In developing an educational framework that can adequately represent a paradigm shift, the first step is to observe the ways in which contemporary design typically defaults to Western assumptions and processes. This colonialist paradigm is particularly evident in the dynamic between designer, client, and outcome. Fig. 1 illustrates the positionality of the designer at the centre of the Western

design process. By being in the centre, the designer exerts power, control, and authorship over both the client and the outcome. While not a strictly hierarchical relationship, this paradigm still supports a set of highly controlled and predetermined relationships. There is no bidirectionality, no intersectionality, and no room for an outcome that is not completely modulated by the designer. This configuration mirrors the dominance of the colonizer over the colonized.

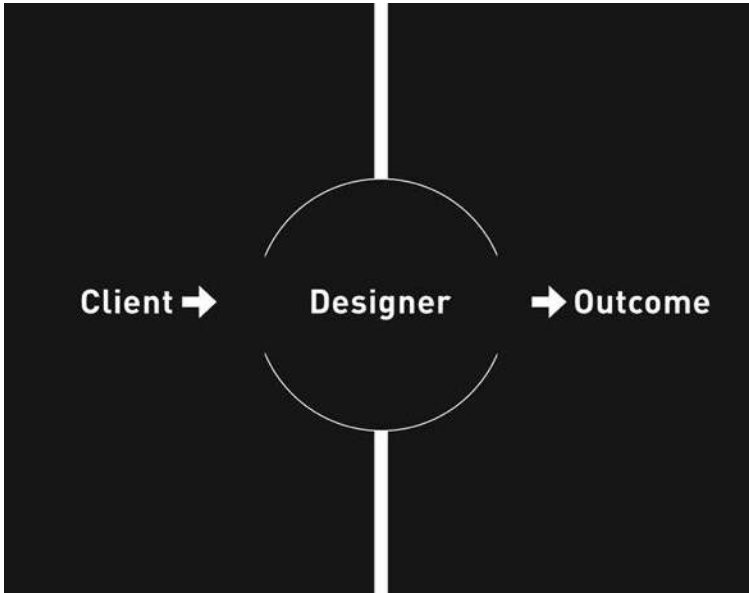


Fig. 1
Design Relationships in a Western Paradigm. Note: A diagram of the unidirectional designer-client relationship that emerges from the conventional, hierarchical Western design paradigm.

In exploring the possibilities of a paradigm shift, we must examine some of the ways in which this Western paradigm has managed to maintain its dominance in both the institutional and professional realms. Firstly, inherent in the Western model of design, there has been the assumption (or at least the fantasy) that successful design is often produced by a single creator, often a white man. This story of sole authorship is consistently framed throughout design history courses, giving the role of the designer considerable gravity. Therefore, when a design outcome functions well, then these myths are reinforced.

Similarly, within the Western paradigm is the centrality of the designer's power, imposing the force of the self-expression and skill over design elements and principles, and also over clients and colleagues. Frank Gehry suggests that this force can be benevolent — in service of the greater good: "To deny the validity of self-expression is akin to not believing in democracy — it's a basic value — if you believe in democracy then you must allow for personal expression" (Woods, 2010). One wonders, however, if this validity of self-expression has been available to all, given the male-dominated, modernist, and Eurocentric trends in design.

The third assumption of the Western paradigm is one of control. By being in the centre of the paradigm, the designer is in control over both the narrative and the outcome. This is best evidenced in the process of design presentations. Here designers present their

carefully curated arguments to their clients. What might seem like an invitation to collaborate, is more of an invitation to cooperate. The design presentation, however well-conceived, is there to build confidence in the designer as the leader, and thereby will lead to inevitable design outcomes.

How, then, might design processes change, if these colonial assumptions are changed? By putting the prefix *de-* in front of the word *colonize*, we do not just replace one verb with a new verb, we reverse the verb's action. If a *colonized* design process is one that values the authorship, power, and control of the designer, then the decolonized design process must be one in which designers willingly de-centre themselves as the primary mediators of design; that is, to give up power, control, and authorship. This non-hegemonic approach calls for the "redistribution of intellectual privilege" (Gaudry & Lorenz, 2018, p. 225), and shift toward a more responsible and balanced paradigm that emphasizes collaboration, inclusion, and co-authorship.

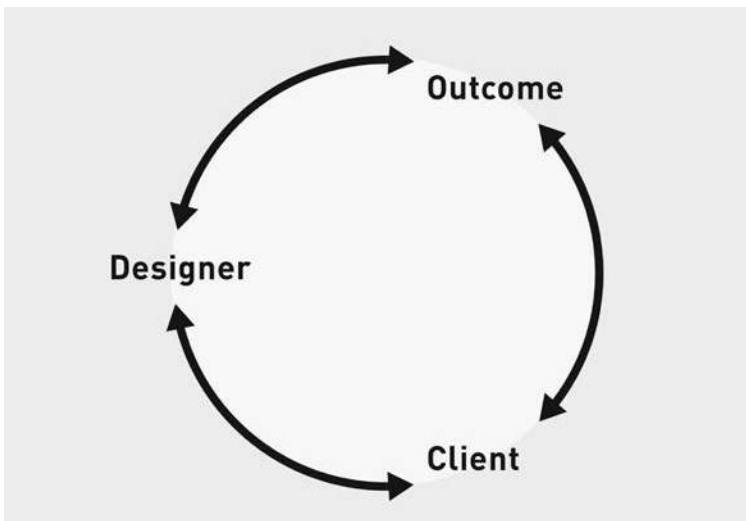


Fig. 2
Design Relationships in a Decolonized Paradigm. Note: A decolonized reconfiguration of the designer-client relationship that removes the Western hierarchical directionality.

This paradigm shift — a shift from a linear to a non-linear process — appears deceptively tidy in diagram form. A model like this might even offer a satisfying feeling of “completion” to anyone who might be eager to rubber stamp any evidence of structural change in the name of Indigenization. However, in everyday practice, this paradigm shift is (and should be) more uncomfortable, when it comes to uncovering and unlearning the tensions inherent within the design process. As Regan (2006) states,

My own deepest learning has always come from those times in my interactions with Indigenous peoples, when I was in unfamiliar territory — culturally, intellectually and emotionally. For Settlers, there is power in this place of not knowing, of unsettling, that is key to our decolonization.

By taking the concepts of sole authorship, power, and control, and de-centering the designer in the process, we find new mechanisms at work. Instead of the myth of sole authorship, we can

move towards a process that instead values and utilizes collective knowledge. Instead of the designer exerting their directive power over the process, the designer might instead assume the role of the facilitator who works to support the dynamics of multiple contributing voices. Instead of exercising predetermined control over project outcomes, the designer would instead emphasize true collaboration, wherein the process is more open to other sources of expertise, and exemplifies how the sum might be greater than its parts.

In applying these concepts of collective knowledge, facilitation, and collaboration to the classroom, knowledge sharing will come from not just from the instructor, but from multiple sources. The primary instructor acts merely as a facilitator rather than a director, and Indigenous knowledge keepers will be hired as co-educators, rather than simply guest speakers. In addition, students will start the course in a class exercise where they situate themselves in their own unique identity, perspective, and cultural backgrounds. This creates a starting point by which students and educators will influence both each other and the outcomes of their assignments. Students will then learn about the Truth and Reconciliation Commission's Calls to Action and the ways in which colonialism has provided the framework for Langara College's education system, as well as the framework for the way that design has been taught Western institutions. Students will be encouraged to reflect on how this framework might be shifted towards intercultural understanding. While working on design projects, students will be asked to explore and deconstruct their own biases and assumptions when it comes to design history. Coursework will include projects that integrate Indigenous and non-Western knowledge, stories, and ways of seeing. Outcomes will be measured both on the success of the designs, but also on the ways that the projects that emphasize collaborative problem solving, divergent thinking, and inclusive, intercultural solutions.

Conclusion: On the Discomforts and Opportunities of Change

This paradigm shift towards a decolonized model of design is by no means a clean and comfortable process, especially given the long history of Western biases that have been internalized by designers and excluded many other voices and creative processes. But it is a necessary shift if designers wish to treat decolonization as an action, rather than a buzzword. As Tuck and Yang suggest in their complex analysis of how one might join in the analysis of settler colonialism within education, "this joining cannot be too easy, too open, too settled. Solidarity is an uneasy, reserved, and unsettled matter that neither reconciles present grievances nor forecloses future conflict" (Tuck & Yang, 2012, p.3).

There is an Indigenous concept of Two-Eyed Seeing which provides a valuable model of collaboration. It was Mi'kmaw Elder Albert Marshall of the Eskasoni First Nation who first applied the concept of Two-Eyed Seeing in a Western setting (Bartlett et al., 2012), and in this context it can be applied to a multi-cultural classroom including Indigenous and non-Indigenous voices. In Two-Eyed Seeing, one eye sees through a Western perspective and the other

eye sees through an Indigenous perspective. Together, these two perspectives form a unified vision that draws on the strengths of both traditions without resting the authorship, power, or control in one eye over the other. *Decolonizing the Design Process*, is an attempt at Two-Eyed Seeing. Just like new prescription eyeglasses can produce feelings of dis-ease and discomfort, a shifting design process might also create feelings of discomfort for students and educators alike. But these feelings are opportunities for cohesion and progress, rather signs of breakdown and disharmony.

Indeed, meaningful change can feel threatening. Change can incite new conflicts, upend agendas, cost money, and hamper deadlines. Despite the unease that these provocations might cause, adaptation also has a way of stimulating growth and forging new pathways, if we allow for it. What this paper does not fully address is the added complexity resource constraints, in terms of time and money, which impacts almost every design outcome.

As the course is scheduled to begin in the 2023–2024 academic year, specific coursework is yet to be determined. Once the proposed curriculum is applied, it will be important to debrief and discuss the impact of the course upon the discipline of design, in terms of the concepts proposed. Decolonization itself is a process, therefore, the educators need to remain open to ongoing analysis and self-reflection, so that they can further adapt the course content and its delivery, in order for the course to remain faithful to the core values of decolonization.

In the meantime, by deliberately reconfiguring the designer-client dynamic, and thereby reconfiguring the student-educator dynamic, we can reinvigorate the designer's own relationship to their process, while also potentially bringing more value to the client, so that they can see themselves as co-creators of the work. Decolonization as a process must change not only design itself, but also its outcomes, in order to create solutions that are more representative of the problems that both designers and clients wish to address.

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OpenMind Handbook. A System of Design Tools and Processes to Empower Democracy Culture in Primary Schools

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Abstract

In this historical moment, the controversial reorganisation of the Italian education system is raising the necessity to reflect on the responsibility of education in defining more resilient societies. Primary schools are the first place where children can actively experience the dynamics of democratic coexistence, developing their relationship with society through a process of long-term encounters. Nowadays, students not only need to acquire basic skills but, above all, to address emerging social issues through education in terms of democratic culture, equality, sharing and collaboration. The research investigated how Service Design can activate participatory processes that can foster the co-creation of educational experiences aimed at raising awareness of social coexistence and democratic participation. *OpenMind Handbook* is a project that facilitates the implementation of new educational experiences and increases social relationships, enabling the involvement of the educational community within a long-term action process.

Keywords

Democracy culture
Participatory design
Community-centred design
Educational approaches
Sustainable education

Introduction

In contemporary society, it has become clear that education will be the first step to achieving the Sustainable Development Goals together. The 2030 Agenda clearly reflects the importance of an appropriate educational response to the current social-cultural situation. Education is explicitly formulated as a goal in its own right: “Sustainable Development Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all” (United Nations, 2015). Within this framework, the thrust for Education for Sustainable Development by UNESCO has never been greater. In a moment when the international community is called upon to define and launch new initiatives for peace, well-being, prosperity and sustainability, educational systems are also called upon to foster the development and formation of citizens of sustainability (Wals, 2015). Education systems must respond to this pressing need by defining learning objectives and content, introducing pedagogies capable of empowering learners and urging institutions to include sustainability principles in their management structures (Rieckmann, 2017). In this perspective, education should be transformative and “allow us to make informed decisions and take individual and collective action to change our societies and care for the planet” (Unesco, 2005).

Methodology

The research investigated how Design tools and Service Design methodology play a fundamental role in preparing students to face the challenges of today and the future. In particular, the focus of the analysis centred on the potential of Design as Democracy (Manzini & Margolin, 2017) as a tool for activating participatory practices aimed at raising awareness of social coexistence and creating valuable interpersonal relationships. The field of primary education was chosen as a design space and was analysed on an Italian and European level, taking particular account of problems, areas for improvement, and opportunities for innovation. As a result of the identification of project opportunities in the education systems of Italian primary schools, the authors designed the *OpenMind Handbook* as a tool for action in the field. The solution was developed and explored through 12 interviews and 2 co-design sessions with experts in the field, teachers, librarians, and pedagogues to deepen the topic and develop the service through a co-participative process with potential users.

The Role of Education in the Universal Agenda

The 21st century was characterised by “public education essentially aimed at supporting national citizenship and development efforts through the form of compulsory schooling for children and young people” (International Commission on the Futures of Education, 2021). Traditional education systems (i.e., based on the acquisition of cognitive skills, structured by age groups and adopting standardised curricula) have wrongly emphasised the values of individual success,

competition and economic development, to the detriment of relationships, interdependencies, mutual care and solidarity (Robinson, 2010). This is the result of a mindset that does not consider the long-term sustainability of our shared lives.

A new “social contract for education” (International Commission on the Futures of Education, 2021) must enable us to think differently about learning and the relationships between students, teachers, knowledge, and the world and help create a culture that embodies values such as equity, inclusion and democratic participation (Council of Europe, 2020). As also highlighted by Rieckmann (2017) Education for Sustainable Development requires a holistic approach to both pedagogy and assessment, *moving education from teaching to learning*. It requires a transformational, action-oriented pedagogy that supports self-directed learning, participation and collaboration, a problem-solving approach, trans-disciplinarity, and formal and informal learning. Education approaches based on these principles not only prepare students to be future citizens of sustainability but also develop in them socio-relational, emotional and behavioural skills that foster democratic coexistence. Indeed, educational practices in this direction can stimulate democratic participation, reduce intolerance and prejudice and decrease support for violent extremism (Barrett, 2016).

Design as Democracy: A Participatory Experience in Education

The historical moment we are living through has led citizens to feel increasingly isolated and to consider individualism to the detriment of the community. This phenomenon leads us to reflect on the role of design in activating public participation for imagining new forms of active democracy at a time when the crisis of democracy has reached its highest level in fifteen years across the planet (Freedom House, 2022). According to Barrett (2016), democracy is based on laws and institutions, but it is visible and tangible in the actions and behaviour of citizens. For this reason, we refer to the concept of *culture of democracy* rather than democracy. The meaning of democratic culture assumes that, while democracy cannot exist without democratic institutions and laws, such institutions and laws cannot work in practice unless they are grounded in democratic values, attitudes and practices (Barrett, 2016).

The concept of democratic culture considers not only the democratic construct but also how democracy is put into practice by each citizen in different contexts of action. Can Design help to update the ideas and practices of participatory democracy? Is it possible to introduce these practices into educational experiences? The definition of democracy can be extended to its more “designing” dimension, i.e. hybrid space, both physical and digital, equipped to offer people greater opportunities to meet, initiate conversations, and collaboratively conceive and enhance their projects (Tassinari, 2017). Design offers the possibility to make the interests of social actors visible and tangible and to provide spaces where “conversations for action” on common interests can take place. This allows actors the possibility of transferring conversations into action. In this

scenario, educational and pedagogical discussion poses a critical question: how can schools educate students to develop a sense of common identity by transmitting their cultural heritage while we are part of a globalisation process (Robinson, 2015)?

In schools, culture should be interpreted as the connection between the competencies educated, the motivations from which they originate and the space-time context in which they are applied. This process helps to present school contents as a product of historical, theoretical, scientific or anthropological becoming, creating a bridge between school and life outside it. Design through participatory processes offers socio-cultural spaces open to debate between different cultural worlds (Tassinari, 2017). These spaces allow shared experimentation and comparison of experiences between a variety of sectors, bringing participants face to face with real situations and combining different ideas and knowledge in a new design that will generate social innovation.

Design Culture in the Transformation of Educational Experiences

According to Jerome Bruner (1999), learning is achieved through a collaborative process within specific social contexts. Learning takes place in an “interpsychic” space: a space rich in interpersonal relationships, where first competencies are elaborated and then transformed into the form of thought through a logical pathway. Thus, learning is defined, above all, as a community activity that develops through an active and constructive process. In this framework, design has always been interested in the relationship between humans, objects and spaces, as well as supporting and responding to social-relational needs. Referring to the theme of education, as described above, the need to transform learning into an educational experience responds to two main issues: the first is related to how the educational service is provided, while the second is linked to the need to produce a social transformation within the school environment. In this specific context, design can operate as a social mediator, offering the possibility to cultivate its culture as a means of transformation and development of innovation (Manzini, 2015). For this reason, transferring a design culture into schools and education systems is a phenomenon that can bring several benefits, both to students and to the school itself. Indeed, design culture can intervene by proposing an approach to teaching based on the design process or appear as “a specific attitude towards change and a sense of agency that can be seen within the school as an organisation and in relation to the outside world” (Pierandrei & Marengoni, 2017).

Service Design methodology can be considered a tool to implement a process of cultural change. The potential of design lies in its ability to provide a set of tools and methods that will foster the creation of engaging learning experiences and support organisational change. When we refer to the Service Design approach, we mean to consider a methodology that sees the human being at the centre of the discussion (Clatworthy, 2017), in which attention is paid to the process and the complex system of information and interpersonal relationships. This methodology, when transferred to

other contexts that do not necessarily have to do with design, allows for an “exploratory process that aims to create new kinds of value relations between different actors within a socio-material configuration” (Clatworthy, 2017). In this scenario, educational action is thus *process-oriented* rather than *outcome-oriented*. In this perspective, educators might also be more inclined to connect the educational experience with the broader context of interpersonal relationships, environmental influences, everyday life and territory. If learning looks like an experience, the school is no longer a container but a space for educational relationships (Zurlo & Maurer, 2022). Educational platforms can connect different users and stakeholders through a collaborative approach. By its nature, design has the capacity to integrate different knowledge in a holistic and multidisciplinary approach. “Thus, educating through Design will help children to use their creativity beyond the limits of expression and as a tool to become critical thinkers and problem solvers, with the aim of forming a future generation of more knowledgeable individuals” (Pierandrei & Marengoni, 2017).

Toolkits as Support for Improving Education

The research described above, supported by interviews and co-design sessions with experts in the field, enabled the authors to identify a design opportunity within the education system. How could Design experiences facilitate participatory democracy practices within school contexts and, in particular, within educational processes? Considering the primary school as a reference context, the insight analysis that emerged from the interviews and co-design sessions with teachers, educators and pedagogues underlined the importance of the concepts of words, reading and listening as tools for strengthening the culture of democracy in schools. Indeed, in a democratic landscape, words play a fundamental role. Democracy is discussion and common reasoning (Zagrebelsky, 2006), based on the circulation of opinions and ideas. Nowadays, there is a growing necessity to use inclusive forms of language (Reale, 2021), free from prejudiced, stereotypical or discriminatory opinions. There is a correlation between languages, inclusiveness and democracy, particularly when referring to social inclusiveness. Literature occupies an important role in providing the basis for developing and spreading a culture of democracy from an early age. Reading is a form of lifelong learning that exercises its only real reason for being in the expressibility of the world. Research in the psychological sciences has demonstrated the impact of stories, particularly fiction, on processes of social cognition (Castano, 2019). The book is therefore a pretext for fostering multicultural experiences, discovering social relationships, creating new ones, and strengthening those that already exist.

Design offers new learning opportunities through the application of strategies, tools, or resources to the reading experience. In the educational context, toolkits are a collection of design tools that can be provided to teachers and educators to supplement existing pedagogies with new exploration methods, considering the skills of all the people involved. Toolkits are designed to address multiple distinct knowledge areas, and tools can be described as open systems

(Conole & Oliver, 2002) that continually evolve based on the context in which they are applied. Considering the topic of reading, a toolkit based on design thinking processes enables creative processes in students and empowers teachers to create effective learning environments by offering new tools, methods or approaches to carry out collaborative activities and develop new approaches to interact with the educating community.

Designing Tools and Approaches to Educate Towards a Democratic Culture

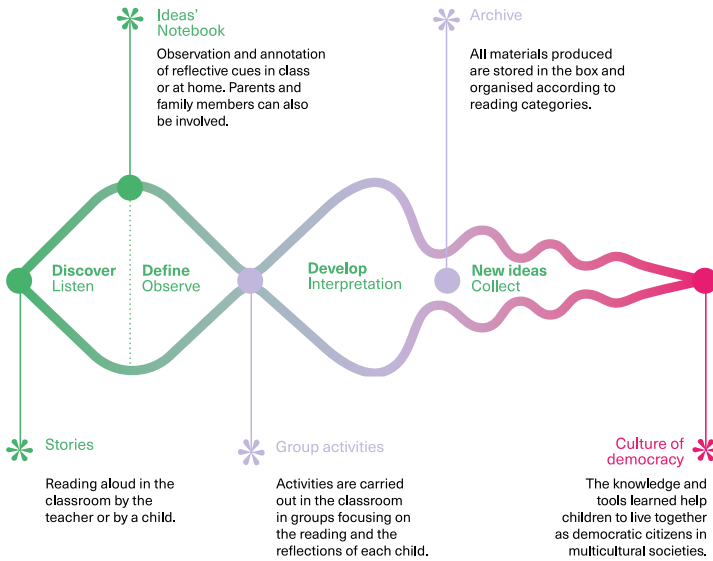
The scenario outlined above provided the theoretical basis for developing the *OpenMind Handbook* service Fig. 1. The project is still in the concept phase; the toolkit has been designed through co-design and interviews with experts in the fields of design and education, while the digital platform has not yet been developed. The project refers to the context of primary schools in the Italian context.



Fig. 1
OpenMind Handbook.

The *OpenMind Handbook* aims to provide a system of tools and processes to support classroom activities based on reading stories and narratives. *OpenMind* proposes a model of educational work based on the creation of participatory experiences with the involvement of schools and local stakeholders such as libraries, associations, institutions, and organisations to enhance the educational contribution that these actors can offer Fig. 2. It provides the opportunity to establish a wide network of relationships with local stakeholders that allows schools to build territorial communities attentive to the development of a shared democratic culture. In particular, the service relies on the relationship with neighbourhood libraries that provide their resources both in terms of books and expertise around the topic of reading to enrich the learning experience.

Fig. 2
OpenMind Handbook
service system diagram.



The *OpenMind Handbook* is a service system that offers a digital platform and printable resources. The digital platform allows schools to register for the service, access materials, and communicate with other participating schools. The digital platform is the virtual space for inter-school relations: it is possible to share educational experiences, new tools and books or participate in events. While the free downloadable kit contains useful materials for teachers to implement participatory reading activities. The kit includes a *Guidelines Manual* for educators, a *Bibliography*, *Tool Cards*, *Activities Canvases*, *Ideas Notebook* and *Archive Box* for archiving activities. In particular, the bibliographic list provides book suggestions about the themes of *democracy, children's rights, civil and human rights, freedom, sharing, equality, welcome, racism, and personal and socio-cultural identity*, while tool cards are the collaborative tools to be used to carry out the activities in the classroom. The tools are used to convey the activities and stimulate students to think about complex issues. Each year the kit is implemented, and each school receives an updated package with which they can integrate the materials used in the previous year.

Teachers and students follow an annual process of reading, exploration and analysis of issues related to the culture of democracy, following the process proposed by the Double Diamond model Fig. 3. Reading is a means to get in touch with specific themes that, through listening to stories aloud, begin to be explored through the use of the different senses. The reading-analysis process follows four well-defined steps. The initial moment of shared reading in the classroom is followed by an individual research phase and the collection of information through the *Ideas Notebook*. As well, children at school and at home can write down thoughts, reflections, and questions and involve family members in this activity. The exploration and observation phases are followed by the interpretation phase,

in which students can develop their ideas using the *Tool Cards* and the *Activities Canvases*, integrating them with the reflections noted in the Idea Notebook. All the materials produced are collected and filed to create the *Archive Box* of inspirations that can be consulted whenever necessary. The active and participatory reading process enables the development of democratic learning environments. *OpenMind Handbook* is organised according to various activi-

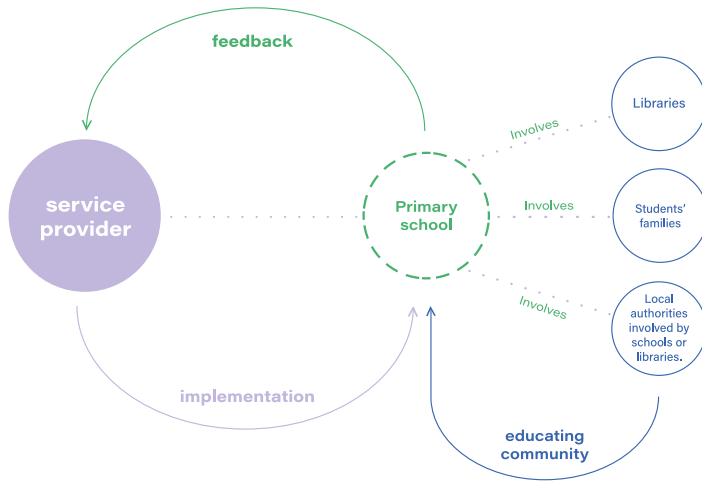


Fig. 3
OpenMind Handbook
design process.

ties, experiences, paths and processes designed and planned by designer, but needing implementation by the teachers. The main purpose of *OpenMind* is to offer flexible, scalable and adaptable processes that create educational environments in which users cooperate to create active communities where everyone feels participant and agent of change in a shared process. Design acts as a mediator in the educational context offering the possibility to cultivate its culture as a medium for transformation, development and innovation of educational paths with a vision for the future. The “educator designer” is the one who researches, identifies, defines, plans and sets up all the “touchpoints” necessary for children to be triggered and involved in a cognitive-emotional educational experience that considers the socio-cultural characteristics of the context. Indeed, the culture of design is proposed in *OpenMind* as a design methodology, both in the organisation and application of the tools and in the whole process of reading aloud in class. Reading in class and the related activities follow the phases of the design process through moments of divergence and convergence that lead to the achievement of a common and well-defined objective: the development of a democratic culture. *OpenMind* is therefore a specific attitude towards change in which the actions taken are visible in the school and the relations with the outside world, starting from the local context.

Conclusion

The introduction of design culture into the school landscape provides new ways of reinterpreting educational processes by focusing on children's sensitivity. This enables the empowerment of students' competencies and skills, helping them to use their creativity beyond the limits of expression. Participatory education processes also develop the community dimension within schools and classrooms, leading to the involvement of external stakeholders such as families, libraries, local authorities and organisations. In addition, active participation makes it possible to develop a micro-educational direction, according to a pedagogical interpretation of community development that can cultivate the substantial and not only the formative dimensions of democracy. Reading in a group is, therefore, an example of democracy, in which it is necessary to find a way of being together, respecting everyone's time, listening and building together an intelligence of things starting from the inspiration of the stories told. Regarding the *OpenMind* Handbook design project proposal, authors consider design learning experiences as "micro" product-service systems in which several spheres interact and probe each other through a series of different encounters, experiences, actors, actions and touchpoints. In fact, the dynamism of the *OpenMind* system is achieved through the active participation of its actors. There are different users involved, each one making specific contributions to the system, that are essential for its sustainability and continuous evolution over time. The service system is proposed as a starting point for co-design educational experiences involving not only schools but the whole local and national educational community to empower democratic societies.

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Architecture, Design and Community in Colombia. More Urban, More Rural, More Social: The Workshop Experience

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Abstract

This contribution reflects on two challenges: the first focuses on analysing how architects-designers, teachers-students, should apply post-pandemic projective thinking from the academy. On the other hand, to make a critical reflection on how specifically from the PUJ Cali, under the methodologies of service-learning, co-design and placemaking, work has been done and can continue to be done in favor of small disadvantaged communities with the intention of producing significant changes for them. Especially after the pandemic, we wonder how it would be possible to orient these experiences towards a more collaborative, inclusive, transdisciplinary, collective and transcommunity learning system, moving away from hegemonic positions. How these workshops have a direct impact on the communities of school-age children and increase their well-being in multiple aspects, as well as improving their coexistence and behaviours. Valuing research work in conjunction with the community highlights the importance of appropriation by those directly involved when they feel part of the work process.

Keywords

Architecture
Co-Design
Education
Community participation
Workshop

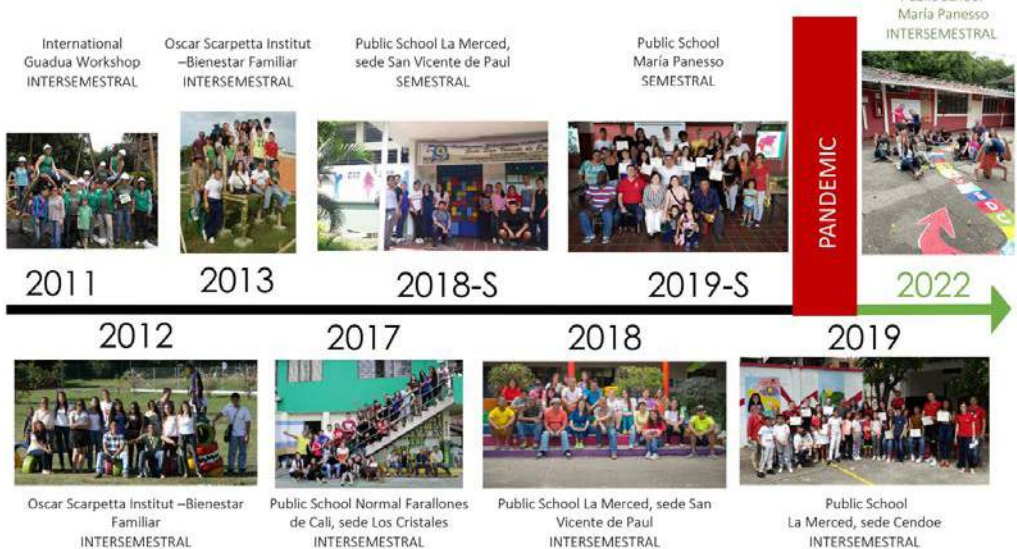
Framework of an Experience

Tapping into the talents and ideas of the community is crucial in deciding how to improve an existing place or in building a vision for a new place. The people who live, work, play, or study in a place offer valuable insights, historical perspective, and a unique understanding of the issues that matter most. The sooner they become involved in the process, the better. (K. Madden, 2018).

In the context of a country like Colombia, which has high rates of neglect of vulnerable sectors such as school-age children, which increased significantly after the pandemic and became one of the most affected populations, social responsibility stands out as one of the main focuses for academia to work on. In other countries, these practices have already been recorded and have served as a theoretical and practical reference, although it is always necessary to review every detail due to differences in context and community.

Since 2011 the Department of Art, Architecture and Design (DAAD) of the Faculty of Creation and Habitat (FCH) of the *Pontificia Universidad Javeriana Cali* (PUJC), leads the workshop More Urban, More Rural, More Social (MURS). From its second version, the workshop focuses on vulnerable and disadvantaged populations of school-age children. This is an interdisciplinary project led by three architecture teachers, accompanied by an art teacher and a design teacher from the same faculty, which also has the guidance and support of psychology and pedagogy teachers. MURS takes place during two consecutive weeks of work each year and is based on a methodology of working together with the community developing short-term projects to solve specific problems in order to improve the quality of life of the children.

Fig. 1
Timeline MURS. Own
elaboration. 2022



The extreme conditions experienced during the pandemic have been an opportunity to rethink from the academy our own methods of education, learning and service, in order to give tools especially to future architects and designers students of FCH of the PUJC, to acquire skills and abilities that allow them to face the different challenges that in our context directly affect such a varied and particular society. The idea of considering the pandemic crisis as transforming multiple things for the coming years means that its social and behavioural implications may be permanent, affecting the way we produce and consume knowledge, and the way we share and disseminate it as a direct manifestation of our culture and idiosyncrasy. In this case, focusing on vulnerable populations of disadvantaged school-age children.

In June 2022 we held the first workshop after two years of postponement due to the pandemic. Undoubtedly, this version presented several new challenges: on the one hand the school children showed significant regression in their cognitive and relational skills, on the other hand, many of our students were physically visiting the university for the first time and were perhaps no longer accustomed to social relationships, let alone with such a community. However, it is essential to highlight the success of the workshop and the excitement of doing it again in the future.

Our Methods and References

The workshop is developed in six phases that are derived from the methodologies of Service Learning (López, 2011), Co-design (Burkett, 2016; McKercher, 2020), and Placemaking (Project for Public Spaces, 2017). On the one hand, Service Learning emphasizes the participation of the community by working with children through participatory workshops. On the other hand, Co-design is important because it underlines the fact of working *with* the community and not *for* the community, which is our aim. Finally, the relevance of Placemaking is taken from the importance of making efficient interventions in the short term, which is our condition. Placemaking seeks to improve the space of schools that are in a state of neglect or deterioration, with the main objective of dignifying the educational space through play and colour, promoting playful dynamics that transcend discovery, play and education (Veerman et al., 2012). Our methodology, which seems simple, involves working together with the community and is developed in the following way:

First, defining the place and the public school to work with, which generally has underused or deteriorated spaces that have a negative impact on the educational community and the surrounding public spaces. Second, carry out an initial evaluation of the physical space: observation and awareness-raising are fundamental. At this stage, the interdisciplinary contribution is crucial, as it strengthens the pedagogical learning process by training professionals with a more comprehensive vision that is closer to reality (Llano et al., 2016). Thirdly, working together with the community in defining possible problems to be solved. Our first approach to little children, is through workshops where they draw what they dream of having in their school and what they need. We also do workshops with

teachers and parents, who are always very attentive to collaborate. Fourthly, once the workshops have taken place, information is cross-checked, brainstorming takes place to prioritise, choose projects and identify the specific spaces to intervene, considering the resources allocated. Fifth, working together on the projects: we start implementing the short-term projects. During the process, a photographic record is made to contrast the before, during and after, and to facilitate the systematisation of the experience. Finally, we carry out a critical reflection on the process, the outcomes and the work with the community. This reflection is fundamental for future interventions and for the systematisation of the experience.

Phases			
Co-design	MURS	Service Learning	Placemaking
1 Build the conditions	1 Define the site	1 Project preparation	1 Define the site and stakeholders
2 Immerse and align	2 Conduct protocols	2 Diagnosis	2 Assess the space and identify issues
3 discover	3 Workshops with the community	3 Action planning	3 Visioning the site
4 design	4 Concrete the space to be intervened	4 Relationship between the parties	4 Conduct short-term experiments
5 Test and refine	5 Execute rapid projects	5 Realization and implementation	5 Continuous re-evaluation and long-term improvements
6 implement and learn	6 Critical reflection and definition of long-term projects	6 Recognition	
		7 Evaluation	

Tab. 1
Own elaboration. Adapted from: *Tabla 1. Relación Metodológica MURS* (Quintana, 2022, p.333).

The workshop benefits from the interaction with other disciplines and, of course, from the interaction and work developed with the communities. Working with the community from the beginning is fundamental in our workshop; it is worth mentioning that this collaboration has multiple possibilities to be carried out. Co-design implies the possibility of building new skills for all the participants, in the case of MURS are the students and teachers of the university, as well as the community of school children, their families and teachers. Everyone has something to teach and something to learn. Co-design is a design-led process that uses creative and participatory methods (Burkett, 2016).

Other of our most important international references is the Australian non-profit organization *Playground Ideas*

In many schools throughout the developing world, education environments are not conducive to learning, and provide few opportunities for child-led discovery or play. The lack of early stimulation has long-term consequences [...] Through play, children develop the neurological building blocks essential to further learning and growth. They form connections, build social and emotional skills, and develop positive long-term attitudes to discovery and learning. Play is not an alternative to learning. It is not a diversion from learning. Rather, it provides the foundation for learning and has an important role in shaping a child's capacity for, and attitude towards subsequent learning. (Playground ideas, 2015, p. 8).

Several medical, psychological and educational studies have shown that there are two main factors to improve the quality of life of children; on the one hand, the importance of good nutrition, on the other hand, the importance of play and color in children's spaces that ensure places for the healthy enjoyment of children, encouraging their playfulness and creativity. The benefits that play provides for individuals have been tracked over decades.

Play in the early years of life has a profound and lasting influence on a child's health, wellbeing, and long-term development. Studies have shown early play experiences to shape a child's physical growth, capacity for learning, chances of finishing school, future employability, and even income. (Playground ideas, 2015, p. 7).

Developing strategies to increase play during early childhood creates the foundation for an individual's development of cognitive, language and psychosocial skills that help to determine their lifetime earnings (Gertler et al., 2014). These factors contribute to a significant improvement in the immediate present but also increase their cognitive abilities and possibilities of education and future opportunities for their quality of life. The lack of both factors is a common denominator in many of Colombia's public schools, which was significantly accentuated during and in these days after the pandemic.

Understanding the power of *play* and *color* as determining tools in these projects has been of fundamental significance for our interventions. This is possibly a variable for which we do not yet have a rigorous measure of assessment, but which we can record in a continuous observation exercise once the interventions are completed and the children express very different ways of relating to each other and to the spaces intervened.

The methodological structure of service-learning and *Participatory Action Research* (PAR), in which the contribution and working together with the community is crucial, intersects with and articulates specific intervention methodologies in public space such as *Placemaking*, *urban acupuncture* and the postulates of Jan Gehl to propose a safe, human and vital public space. The methodology we apply is also related to another one of our references: *Project for Public Spaces* (PPS), which is a non-profit organization that helps to create community-led projects in public space. They have worked with more than 3,000 communities, in fifty states of the United States and in 43 different countries. PPS has proven that community-based work is the most effective approach to creating and revitalizing public spaces (<https://www.pps.org/>).

Playground ideas and PPS have been relevant to carry out this type of intervention following an applied research methodology, in which art, colour and play are a fundamental part of the proposals, since they do not only improve the quality of the intervened spaces, but also and, above all, directly and positively influence the wellbeing of the community involved, which in this case is mainly children and young people of school age.

Moreover, the focus on values and ethics in the workshop is directly associated with the three functions that this type of meaningful experience achieves from Service-Learning: To train in the real environment through education in values and reflection on practice. Help to connect educational centres with the environment

and promote the philosophy of learning by doing. To obtain the best academic, cognitive, civic, vocational, professional, personal, social and moral-ethical results (López, 2011).

Within the state of the art, we analysed in MURS projects that carry out similar activities with the community.

Zaera Polo (2016) mentions a series of architectural studios known as activist offices such as *Urban Think Tank*, *Assemble*, *Orkidstudio* among others, which focus their work on citizen participation projects, and which, as far as possible, seek the greatest possible impact by economising on materials and time, with a view to directly addressing the needs posed by the users themselves. (Quintana, 2022, p.341).

CHALLENGES - NEEDS



METHODS - RESULTS - FINDINGS



VALUE - RELEVANCE TO



The Workshop: Problems and Challenges

The workshop is of short duration and, as mentioned, its methodology has been complemented with Placemaking, to guarantee the success of the interventions in the short timetable established for their execution. Project-based learning is the main pedagogical basis with which architecture and design students approach proposals alongside the community (Quintana, 2022).

One of the main objectives of the Workshop is the participatory community design; which is fundamental and one of the greatest challenges of MURS methodology. MURS breaks with the usual, daily scheme of lessons in the classroom and moves from interacting in this traditional physical space of the university, to go out to places in the city where there are underprivileged communities and where it is essential to interact with the real users of the projects. MURS has been constituted as a learning tool especially for future designers and architects, as well as a key instrument that shortens distances

Fig. 2
Problems- Solutions.
2017, 2018, 2019. Own
elaboration.

and social barriers in a country like Colombia with such marked differences. Therefore, there are 3 main actors in this process: Community (Directors, teachers, children/students, parents), Academy (interdisciplinary university teachers and students from different careers), and Sponsors, who put their trust in the team and a restricted amount of money to carry out the projects in a short time. A question that arose was how to involve and sensitise students to the different problems of communities in the city and country, considering their context, geography, climate, socio-economic reality and particular problems, and how to sow the seed of solidarity and empathy so that it will remain when they become professionals.



Fig. 3
Problems- Solutions.
2017, 2018, 2019. Own
elaboration.

Specifically, we wonder how this proposal can be inscribed within the framework of *Participatory Action Research* (PAR) developed in the social sciences, conducted by Paulo Freire in Brazil and Orlando Falls Borda in Colombia. This is a research in sociology and education that works hand by hand with the community in the development of research projects, and is consistent with that community, precisely because it takes it into account from the beginning, trying to maintain a horizontality, not easy to achieve, in order to unite experiences and arrive at correct and appropriate results. "From the study of these new confrontations, new practices, new postulates and new research alternatives are emerging in Latin America. One of them is PAR" (Chavez, Navarrete & Venegas, 2004, p.184).

This kind of working methodology was directly affected by the time of the pandemic, but still left open alternatives to be thought and developed without really losing the link with the community. In the case of MURS, it is likely that, due to the nature of the architecture and design projects, it will not be possible to maintain exactly the same methodology that characterises PAR. What would be the conditions that would allow us to inscribe MURS in PAR? what is maintained and what is transformed?

This workshop is committed to the well-being of early childhood in a holistic way; that means, in what is related to health, nutrition, protection and everything that implies well-being in gen-

eral. This is how the Workshop is framed in some of the Sustainable Development Goals, such as: SDG 1 No poverty; SDG 2 Zero Hunger; SDG 3 Good health and well-being; SDG 4 Quality education; SDG 5 Gender equality; SDG 10 Reduced inequalities. Many studies have shown that increasing the amount and the quality of play in educational settings can improve the long-term outcomes of disadvantaged children. Studies, such as Gertler et al., 2014, have shown that educational games, psychosocial stimulation and good nutrition help to improve the education and, years later, the income of the most disadvantaged. “Moreover, stimulation had positive impacts on psychosocial skills, schooling attainment and reduced participation in violent crimes” (Gertler et al., 2014, p.4). Thus, good nutrition and educational games not only improve the education and future earnings of the most disadvantaged, but also help to break the intergenerational transmission of poverty.

Some Results and Findings

Having had the opportunity to work for 5 years in different schools in the same sector of the city, gave us the opportunity to understand and address the problems in a more genuine way, as well as to see the positive impact and the level of ownership that has been achieved by the community. We discover that in addition to solving a spatial and aesthetic problems, the work carried out had an impact on increasing school enrolment, improving the quality of life of school-age children, and generating ownership by both the educational community and residents. Some evidence is the 200% increase in the enrolment of a public school that was about to close, the improvement of the academic, ludic and social quality validated by the teachers at the intervened public schools. In quantitative terms, they have been positively impacted by this work two thousand two hundred (2,200) children, four (4) public schools, and one (1) institute. One hundred and twelve (112) students from twelve (12) different careers have taken part, five (5) regular teachers and five (5) itinerant teachers from the university. Two (2) foundations, one (1) international university and some volunteers. Other positive results of this workshop are mainly reflected in other significant instance: in the students at the university who will soon be professionals now with a broader vision and closer to the reality of the country. Testimonials from our university students have shown that their participation in the workshop has been a determining factor in their professional and personal development.

During the pandemic in 2020 and 2021 the workshop was suspended. Although the first post-pandemic workshop was a big challenge for everyone, the results show that it was decisive, meaningful and effective. With this version, we corroborated that it is essential to understand and become aware of the power of this type of joint projects and, in that sense, to try to start finding different ways to show the positive effects, from an emotional point of view, for all parties. Perhaps we still do not have fully defined the variables to measure these intangible benefits; however, with the testimonies received from our students and schoolchildren and with the recording of observation exercises once the interventions have ended, it is

evident that the children express happiness and very different ways of relating to each other and to the new spaces and projects. Incorporating participatory design is a highly meaningful experience in which all actors benefit, especially school children, who are inspired by the interventions and motivated to receive quality education at such an important stage of their lives as childhood.

What are the post-pandemic lessons to be learned, especially in the Colombian context, where many other issues exacerbate the problem? In the case of MURS, several things: Perhaps thinking in terms of a laboratory rather than a workshop could provide the possibility for the community to continue with the processes once the time of “working together” is over. In that sense, it would be valuable to build a booklet for each experience, which could collect the inputs given by the community itself and the possible solutions that emerged from those inputs. It would function as a logbook, a navigation chart and a tangible link between community, project and participants, as well as a record of the permanent reconstruction of the joint experience. Additionally, it is important to make more conscious a pedagogy of participative community design / action / production, along to co-design, Placemaking and Service-Learning. To demonstrate an applied and transformed PAR methodology for architecture and design, which should lead to true joint and community work that is as horizontal as possible without losing the meaning of differences. In this sense, it is possible that the act of *learning* is underlined, and the act of *teaching* is blurred.

For the last MURS conducted (June, 2022), we found it necessary to return to the same school where we worked before the pandemic. We understood more clearly the importance of strengthening the links already established, as it was a way of not only continuing to contribute to a community with which work had already begun, but also to return meant giving back a little of the hope that had been lost during the recent difficult times. Despite the additional challenges, we have had a wonderful experience.

Fig. 4
Tools: Observation +
Pencil + Paper. Own elaboration.



As academics and researchers, we seek learning based on the search of the potential of the place, context and community that inhabits and uses it. Thus, there is a strong interest in taking small-scale projects and design exercises out of the classroom, to promote through co-participation with real communities' solutions for real problems and situations. Social work, the approach and interaction with the community become the main input of the co-design and the resulting projects; it becomes a joint and united work between all the actors: academy (teachers, researchers, students), community (directors, teachers, students, parents, neighbours) and sponsors, a way of learning in practice, in the making.

Novelty and Value of the MURS Experience

There are few opportunities for students to step out of the traditional classroom and have the experience of materializing an idea into reality with their own hands. For this reason, the version after the pandemic was doubly significant. Related to this, this version of the workshop taught us several things: It is essential to have clarity and awareness of available resources from the beginning of the workshop, and within the initial planning idea, students must be clear about the costs and use of available materials. This awareness translates into the optimization of resources and organization of time and efficiency in the work; this reinforces the philosophy of learning by doing, and is one of the most important qualities of Service-Learning. The interventions are intended to be pedagogical activators that help teachers take advantage of scenarios other than the classroom to explain various topics to the children, or that they themselves do it on their own initiative through play and self-discovery.

As it is necessary to bring together several logics (norm, community, academia, research, resources), each experience becomes unique and singular; however, it is important to find the generality that unites the particularities and to make it evident. The design and project processes approached from understanding that among Co-design, Placemaking and Service-Learning, the PAR is also a methodology that incentive and a driving force that generates knowledge in both directions. It is a learning methodology that in reality aims at joint work between both parties and nurtures academically and personally the individual and collective experience among all the active actors in the processes, which largely guarantees acceptance, appropriation and care by the community itself, as both academic knowledge and popular and experiential knowledge have been taken into consideration.

The students benefit in multiple ways from participating in the workshop. This was most evident in the last version, as it meant an additional challenge in multiple aspects such as resuming interaction among them and finding the most appropriate way to interact with the community. This also reinforces the idea of knowledge acquisition and retention proposed by Ausubel (2002), in order to achieve meaningful learning.



Fig. 5
Tools: Brainstorming.
 2017, 2018, 2019. Own
 elaboration.

Although the pandemic prevented the workshop from continuing, it became a space for reflection. We were therefore faced with the challenge of how to take it up and continue it after the pandemic. Based on our past experiences of MURS, how to deal with future ones? From this point of view arises a question about how to make future architects and designers of PUJ Cali aware of the emerging challenges, considering that the way in which knowledge is imparted and expanded must begin to be transformed. It is feasible that it must transcend to a knowledge that is possible to be produced also from the own experience of teachers, students and community. Projects and designs made today will have social implications in the future; for this reason, it is necessary to be responsible when thinking and considering new methods of education, learning and service, without ignoring the fact that thinking about future practices is based on critical and analytical reflection on past practices.

Considering knowledge nowadays as a product, a service, a space, a time, encourages us as researchers, teachers and academics to share our experiences and studies on design-driven processes and small-scale impact projects related to non-conventional formats, methods and content, in which interactions, local spaces, relationships and processes of production, recreation, application, distribution and regeneration of education are evident.

As an educational community, it provides us with tools to continue research in an improved way — creation, applied research. We will strengthen ourselves as a team and enhance the work and research methodology. From the academic point of view, we transmit, maintain and strengthen this type of learning that takes place outside the classroom. The fundamental goal of this initiative is to contribute to the improvement of the quality of life of the community, especially the child population of school age. It also means the continuity of a process started several years ago, which is framed within the methodology of learning and service and Participatory Action Research, in tune with specific artistic-architectural projects that interdisciplinarity involve teachers and students from different areas, careers and semesters. Finally, this initiative could lead to a pilot project, feasible to be continued and/or replicated in other spaces.

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before



after



Fig. 6
Short- Term Projects.
2017. Own elaboration.

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Creative Community for Generation Z Teachers in Brazil Through Strategic Design

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Abstract

This paper aims to examine the lack of engagement by Generation Z teachers in Brazil. We propose that Strategic Design offers new meanings by engaging in social innovation through the establishment of creative communities within the context of digital transformation for these teachers to explore other teaching spaces out of schools. The objective of this study is to gain insights into the functioning of a creative community and its potential to accommodate Generation Z teachers. To achieve this objective, we employed a netnographic analysis approach within the CoNUMidade Turbo of NUMI Educação for ten days. Additionally, interviews were conducted with the community's creators. The findings suggest that the establishment of a creative community requires the understanding of generational needs, also adopting a horizontal management structure to empower a collective creation and to foster connections, sociability, and affectivity between the members.

Keywords

Creative community
Generation Z
Strategic design
Social innovation
Entrepreneur teacher

Introduction

In this paper, we demonstrate a concern regarding Brazilian teachers, especially those born between 1995 and 2010, called Generation Z. GenZers have experienced the influence of digital transformation throughout their lives. The primary concern pertains to the lack of interest exhibited by Generation Z in becoming teachers, as evidenced in the study conducted by Instituto Península in 2021. This lack of engagement results in a diminished inclination to pursue a career in the field of Education.

The Instituto Península study investigated participants' thoughts on becoming teachers in Brazil. The findings revealed that only "5% of respondents aspired to be teachers, 12% considered the idea, while 50% had never contemplated it" (Instituto Península, 2021, p.37). For young people, several demotivating factors were identified: 1) a lack of patience to be a teacher, 2) the belief that another career would provide more satisfaction, 3) the conviction that there are better professions available, 4) perceiving the teaching profession as excessively challenging, and 5) dissatisfaction with the low salary associated with teaching. Based on these factors, it is evident that various influences contribute to young people's decision not to pursue a teaching career in Brazil, including behavioural factors and observations of the challenging realities of the profession, particularly in Brazilian public schools that suffer from infrastructure issues and offer low teacher salaries.

Furthermore, the interest of current teachers in the profession has also been negatively affected by a high number of teachers falling ill or experiencing health issues due to excessive workloads. This issue of teacher well-being is not limited to the pandemic period but extends beyond it, as highlighted in the study conducted by Trevisan et al. (2022), which emphasizes the vulnerability of teachers to psychosocial and occupational factors, with excessive workload being a significant contributing factor.

The lack of support and care for teachers reflects the diminished status of the teaching profession in society. The survey conducted by IP, FGV, EAESP, CEAPG (2020) reveals a clear disconnect between the demand for teachers and the availability of qualified professionals. Additionally, the same study predicts a higher demand for teachers in the next decade, potentially resulting in a shortage of teachers. The "Risk of a teacher blackout in Brazil" research by the Instituto SEMESP (2022) estimates that the shortage of teachers could reach 235,000 by 2040.

Although the Instituto Península study does not specifically address entrepreneurship, it is noteworthy that 50% of GenZers express a desire to be entrepreneurs (Seemiller, 2017), and 74% of young Brazilians aged 18-34 aspire to become entrepreneurs, though only a third manage to actualize their ideas (Amway Global Entrepreneurship Report, 2018).

Within the framework of Strategic Design (SD), these issues can be understood as wicked problems — social problems that are complex and defy straightforward solutions (Buchanan, 1992; Rittel & Webber, 1973). Strategic Design provides a theoretical-methodological approach capable of generating metaprojectual processes (Bentz & Franzato, 2017) and enables complex thinking (Morin, 2005) within transdisciplinary contexts (Meroni, 2008a) to tackle wicked problems.

Therefore, this paper proposes the utilization of SD as an approach capable of addressing the issue of teacher dissatisfaction in Brazil. This approach, rooted in the intersection of design and education, draws inspiration from various theses published within our post-graduate program, which have employed Strategic Design to develop improved educational strategies for the present-day Brazilian context. The objective is to employ SD as a guiding framework to understand the functioning of a creative community and its potential to embrace Generation Z teachers, thereby generating guidelines for the establishment of a creative community tailored to GenZ teachers.

Moreover, Strategic Design in education places significant emphasis on collaboration and interdisciplinary approaches. It encourages educators to collaborate not only with other professionals such as designers but also with community members, to foster innovative solutions to educational challenges. By integrating diverse perspectives and expertise, strategic design promotes holistic and comprehensive approaches to education.

Considering the frequent association of SD with social innovation, as Meroni (2008a) suggests, we can employ SD to define essential guidelines for constructing a creative community of teachers to support the development of Generation Z individuals as entrepreneur teachers. In this context, entrepreneurship is understood as providing teachers with increased autonomy and opportunities to chart their professional paths freely, beyond the confines of traditional school settings.

The selection of creative communities as a focus of this paper is motivated by the proposition of Mourão and Englert (2019), who argue that these communities actively challenge dominant models of thinking and practice by proposing new ideas and improvements. The dominant model is guided by the mindset that only considers school as a place for teachers' work. Creative communities serve as spaces to foster teacher relationships through attentive listening and dialogue, as the sense of community is closely associated with respect, care, and inclusivity, aligning with the qualities identified by Freire and Oliveira (2017) as necessary for the existence of a creative community: sociability, collaboration, creativity, communication, and distributed knowledge.

However, before delving into the concept of creative communities, it is crucial to establish a clear understanding of the term "community" as proposed by Costa (2005). He conceptualizes a community as a group of individuals with a shared interest. Building on this understanding, we can begin to explore how teacher training for the 21st century is intertwined with the creation of a creative community — a collective of individuals (teachers) who share a common interest in education and teaching and frequently interact within the school environment or virtually. This group of people are not expanding their views to new possibilities alone, so a strategic designer could help them to co-create new paths to their careers out of schools. Therefore, SD can contribute to the development of new realities for education and teachers, as it aims to create new meanings.

Consequently, the research question guiding this paper is formulated as follows: How can a creative community be established to accommodate GenZ teachers? Hence, the objective is to comprehend the functioning of a creative community and its potential to

embrace Generation Z teachers. To achieve this, an existing creative community, CoNUMidade Turbo of NUMI Educação, was selected as an exemplar for study. Despite lacking a specific age range for participants, this community closely aligns with the qualities highlighted by Freire and Oliveira (2017).

To investigate the community, the Netnography method was employed, involving a 10-day monitoring of CoNUMidade Turbo. Subsequently, interviews were conducted via WhatsApp with the community's founders, Sophia and Amanda, who granted permission for their names and the community's name to be cited. The subsequent sections of this paper present the research results and engage in a comprehensive discussion of the study.

Method: Netnography and Interviews

The Netnography method, as defined by Hine (2005), serves as a means of observing online communities. Employing this method was deemed appropriate for comprehending the operations of an online creative community and its potential to attract GenZ teachers. As noted by Hine (2005), the specific forms of interaction, as well as the nature of participation and observation, cannot be predetermined. This justifies the use of the Netnographic method in this study, as it facilitated the analysis of interaction, connection, and collaboration within the community. Consequently, this analysis informed the exploration of creative community possibilities for GenZ teachers. An online community was chosen due to its ability to bring together individuals with shared interests, regardless of geographical location, as the idea is to bring new places out of schools to teachers.

The community under investigation, CoNUMidade Turbo, was monitored for a period of ten days, specifically from August 22nd to August 31st, 2022. This period marked the final days of the community, as CoNUMidade Turbo operated under a paid model with a predetermined one-year contract. The contents available on the Hotmart platform and WhatsApp conversations were analyzed to gain insights into the community. Throughout the observation process, noteworthy observations and insights were recorded during the examination of the conversations. These observations and insights served as the basis for subsequent discussions.

In addition to the netnographic method, semi-structured interviews were conducted with the founders of CoNUMidade Turbo, namely Sophia and Amanda. The semi-structured interview format was chosen to create an informal conversational context, as suggested by Boni and Quaresma (2005). This informality aimed to make the interviewees feel at ease in sharing their perceptions. The interviews were conducted via WhatsApp to maintain the desired informal atmosphere, enabling the researchers to pose additional questions that emerged from the analysis of the interviewees' responses. This approach allowed for efficient data collection and ensured the interviewees' limited time was utilized effectively.

In addition to confirming data related to the community, Sophia and Amanda were asked the following initial questions:

- 1 How and when did the idea of CoNUMidade Turbo originate?
- 2 When was it implemented?
- 3 What were your expectations for the community?
- 4 Why did you choose a community format?
- 5 What do you understand by community?
- 6 Following their responses, Amanda was further asked the following questions to provide clarifications on specific aspects:
- 7 Did you ascertain the reasons why many individuals did not participate in live activities/rituals?
- 8 Did the members of CoNUMidade Turbo genuinely connect with one another?
- 9 How many individuals were part of CoNUMidade Turbo?
- 10 Were the meeting days determined collaboratively with the members or prearranged by you?

Through this combined methodology, the study obtained the necessary inputs and insights for the subsequent discussions presented in the following section.

Results and Discussion

CoNUMidade Turbo was launched by NUMI Educação in Brazil in 2021 with the aim of connecting individuals interested in innovative and meaningful education. Initially hosted on Facebook, the community later migrated to Telegram due to the participants' preference for instant messaging. However, despite the platform change, many members remained inactive. It was not until February 2022, with the introduction of WhatsApp communication, that the level of engagement significantly improved, as indicated in Amanda's interview.

The CoNUMidade Turbo consisted of 68 members who gained exclusive and continuous access to content such as live streams, recorded sessions, texts, videos, and podcasts via the Hotmart platform. The content was organized into eight modules. The stated purpose of CoNUMidade, as described on the Hotmart platform, was to facilitate practical learning of new techniques and creative methodologies while establishing a support network for like-minded individuals to exchange meaningful experiences. Members were expected to actively interact and support one another, participate in live streams (referred to as *rituals* by NUMI), attend workshops facilitated by community members, join monthly meetings to connect with the entire community, and engage in content curation and sharing.

Analysis of CoNUMidade's WhatsApp messages revealed that members connected through personal experiences, shared reminders of meetings and provided feedback on CoNUMidade events. The community also collaboratively planned an event spanning several weeks, where members shared their expertise on various topics. Mutual support was evident as participants sought advice on setting up training and workshops and engaged in discussions related to education.

CoNUMidade Turbo concluded in August 2022, as stipulated in the members' contract. Insights gathered from Amanda's interview highlighted the need for a platform to connect individuals involved

in creative education, as they often felt isolated in their respective contexts. While Amanda expected higher attendance at monthly meetings and rituals, the actual turnout was limited to approximately eight participants.

Sophia emphasized the importance of community from a relational perspective. The exchange of ideas and experiences within NUMI's course groups led to job opportunities, partnerships and friendships. Motivated by these outcomes, CoNUMidade was created to provide a comfortable space for sharing and to inspire individuals to make a difference in education, mitigating their sense of isolation.

The insights gained from the CoNUMidade Turbo provide valuable knowledge for the establishment of a creative community tailored to GenZ teachers. One significant lesson learned is that while shared interests, such as Education, serve as a connecting factor among individuals, it is the discovery of additional commonalities that fosters virtual relationships and skills development. Thus, it becomes evident that solely focusing on a specific topic may not always be the key driver for engaging individuals within a community. Consequently, it is crucial to create opportunities for interaction that transcend the main theme.

Another important aspect to consider is the challenging nature of working within a community, particularly in a society where individuals often expect ready-made content due to their prior educational experiences. Engaging in a community necessitates members' understanding that their collaboration is essential for its growth and development. This observation was evident in the difficulties encountered with the Ritual *Fala, Numiner*. In design terminology, this participatory approach is known as peer-to-peer engagement (Meroni & Sangiorgi, 2011), where all community members actively contribute as co-designers.

Furthermore, leadership within a community is a complex task that requires careful consideration. One crucial lesson for community leaders is the importance of making decisions in a horizontal manner, involving members in the decision-making process, even if it requires additional time. An example of this was evident in the initial pre-set meeting times established by NUMI, which resulted in low attendance from members, not due to a lack of interest, but rather because the timing was often inconvenient. This contributed to a sense of disengagement among members regarding these meetings. However, when the opportunity arose for members to collectively determine a more suitable day and time, engagement improved. This emphasizes the role of the community leader as a designer, working strategically to make decisions that benefit the group (Meroni, 2008b).

When establishing a creative community for GenZ teachers, it is essential to analyze the characteristics of an education-linked community, as previously discussed, while also taking generational factors into account. In this regard, the Brazilian Research Group "Inovação Orientada pelo Design para construção de engajamento em ambientes de aprendizagem (IODA)" at UNISINOS conducted an international survey on Generation Z in collaboration with researchers Corey Seemiller and Megan Grace from the USA. The survey was administered in over thirty countries, with 908 responses obtained in Brazil, although the data has not been published yet.

One pertinent question for understanding Generation Z's preferences and facilitating the functioning of a creative community pertains to communication methods. Young people often exhibit a preference for face-to-face interactions (78%), followed by text-based communication (92%) and direct messaging (48%). Regarding less frequent methods, video calls are favoured by 53% of respondents, phone calls by 54%, and email writing by 47% Fig. 1.

METHODS OF COMMUNICATION

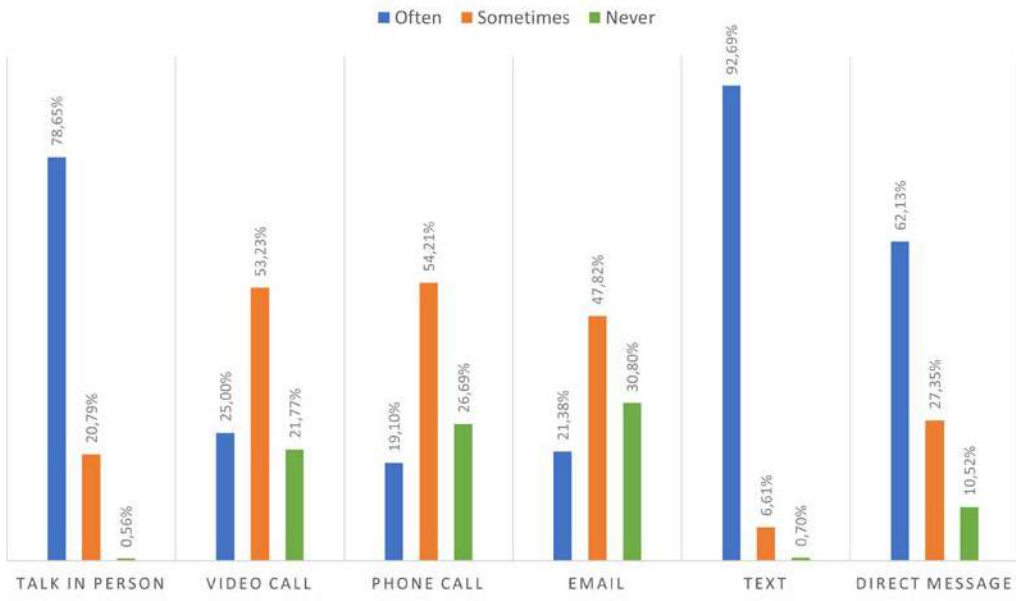


Fig. 1
Methods of Communication, by Author. 2022. Adapted from: Seemiller, C., Grace, M., & Associates. (2022). *Gen Z global data*. Unpublished data set.

Considering these findings, it is important to determine whether the creative community for GenZers should prioritize face-to-face interactions, potentially necessitating more frequent meetings given their preference for in-person communication. However, if online meetings are chosen, it is crucial to acknowledge that video calls may be less frequent compared to face-to-face interactions. Alternatively, a hybrid model can be adopted, incorporating scheduled face-to-face meetings alongside discussions and conversations on instant messaging platforms like WhatsApp.

If it is aimed to create an inclusive environment where GenZ teachers feel welcome and can explore new career possibilities, the creative community could establish a defined timeframe to ensure commitment to the process (e.g.: 1 year). The community might have a membership fee and offer scholarships to teachers who require financial assistance.

Based on the concepts discussed, a potential creative community for GenZ teachers can be envisioned. Led by a designer and a teacher, this hybrid community would accommodate the need for face-to-face interactions while assisting GenZ teachers on their journey. The first meeting could involve discussions on topics to be addressed throughout the year, based on participants' perceived

needs and the leaders' suggestions. Additionally, scheduling meeting dates and times, and determining whether they will be conducted online or in person, would be essential.

The pre-arranged meetings could cover various topics suggested by community members, including conversations to share experiences, workshops to enhance practical skills, and exchanges aimed at fostering connections among participants. This creative community should extend beyond traditional educational settings and function as an informal gathering of teachers seeking new knowledge and opportunities. It would provide a space for entrepreneur teachers to flourish, potentially piquing the interest of young individuals in the teaching profession.

The format of this creative community may pose challenges for teachers currently employed in formal positions, as active participation and engagement require time availability. On the other hand, teachers with more flexible schedules could seize the opportunity to develop themselves and broaden their understanding of potential avenues within their field.

The provision of a creative community, designed to nurture entrepreneur teachers who possess the autonomy to select their workplaces, within an environment that understands, embraces, and fosters learning among its members, has the potential to enhance the engagement of young individuals in the teaching profession. Such an initiative acknowledges that the role of a teacher in contemporary society extends beyond the confines of traditional educational settings and encompasses informal environments, including online platforms.

It is important to note that this model is not the sole valid approach, as there exist numerous alternative methods for establishing and cultivating successful communities. The key lies in comprehending the generational needs, while ensuring that the community incorporates essential attributes outlined by Freire and Oliveira (2017).

Final Considerations

In conclusion, the lack of engagement among young individuals in pursuing teaching as a profession highlights the need to introduce new training formats and knowledge exchange mechanisms to make the field of education more appealing to them. Design can play a significant role in addressing this issue by fostering the creation of creative communities that enhance connection among members and encourage collaboration. Establishing a space for the development of entrepreneur teachers can potentially increase young people's interest in the education profession.

Overall, the CoNUMidade Turbo experience provides valuable insights that inform the establishment of a creative community for GenZ teachers. These lessons highlight the significance of fostering connections beyond shared interests, recognizing the collaborative role of community members, and adopting a participatory leadership approach that involves decision-making in a horizontal manner. It is also necessary to understand the generational aspects involved.

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It is important to note that this study is situated and therefore its findings cannot be generalized but should be viewed as a valuable learning experience. Future research should focus on expanding the investigation of creative communities for teacher training and conducting experimental studies based on the insights gained to establish a creative community for GenZ Teachers.

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Design Thinking and Career Development: A Comparative Study

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Abstract

This study conceives career development as a design process and not as a planning activity. An uncertain and fast-changing professional environment requires adaptation and training in a proper mindset. Since there is no such thing as “expertise” in life, Design methodologies and principles may be helpful for students to develop self-awareness and guidance. This study presents a comparative approach based on Beckman and Barry's (2007) learning framework of the two main career development methodologies for students based on Design Thinking: “Designing Your Life and BE(A)ST” (BE Aware Student). Designing Your Life explores design thinking principles and techniques to help individuals create fulfilling and meaningful careers. BE(A)ST is an approach, process, and set of tools that assist students in designing their careers while still at university.

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Keywords

Career awareness
Career design and development
VUCA world
Social responsibility
BE(A)ST methodology

Introduction

The need to prepare students for the VUCA world has been emphasized in policy documents from the OECD and UNESCO (Hadar et al., 2020). In the current situation of ongoing, unpredictable change that is now typical in several business sectors and industries, career choice is increasingly becoming one of the essential topics for research in personal development and contemporary educational trends. It is believed that no amount of formal education in the classroom will be able to equip graduates to handle current and future workplace disruptions. Therefore, it is crucial we reconsider how we educate and prepare future graduates so that they can not only land their first job but also be flexible enough to fit into the variety of new jobs that will emerge.

As career choice affects the social, economic, and emotional well-being of individuals, it is thought to be among the most significant decisions people make in their life (Hartung, 2011). Its tight connection to the concept of employability has caused a public debate (McQuaid & Lindsay, 2005), regarding the characteristics of a “good” university or degree program. In fact, employability is a central subject that impacts how academic institutions conceive and promote themselves, how society views higher education and its institutions, how scholars educate and study, and how undergraduates create their prospective identities. As a result, higher education institutions across the globe are now working towards increasing the employability of their students. In addition, higher education institutions (HEIs) have made employability a common practice to embed employability expectations and improve student learning outcomes, particularly at the undergraduate level (Fallows & Steven, 2000).

Nonetheless, increasing the employability of their students is a difficult task for higher education institutions, as globalization and diversity in society and the workplace require graduates to acquire social and humane principles (Mtawa et al., 2021), which universities find difficult to incorporate into the curricula. In fact, universities advertise their degrees as options tied to limitedly flexible careers. These options are challenging to uphold because they require negotiating with numerous parties (teaching staff, researchers, management, and career officers) and navigating convoluted administrative procedures. As a consequence, there is an unbalanced relationship between study programs and labor market demands, which can have a detrimental impact on graduates’ careers and life. Connected to wrong career choices, roughly one-third of employees claim that they are not satisfied with their careers (Eurostat, 2015). This indicates that higher education is an insufficient source for work-life preparation since graduation does not guarantee a smooth transition to employment or professional success (Schomburg & Teichler, 2007). Moreover, professional growth and the transition to the next sphere in life are influenced by various internal and external factors. According to Allen and Van der Velden (2007), the transition process has evolved from a simple notion defined as the stage between full-time schooling and full-time employment to a complicated concept defined by these precise conditions but characterized as uncertain. This makes employability a wicked problem, suitable for abductive reasoning (Peirce, 1931) and design thinking (Dorst, 2011).

This research begins by highlighting the importance of career awareness for university students analyzing and comparing the two main approaches to students' career development based on Design Thinking: Designing Your Life (DYL) by Bill Burnett and Dave Evans (2016) and Be Aware Student (BEAST) by Eric Guerci, Joanna Świątoniowska, Maria José Varadinov, and Matteo Vignoli (2022). While both approaches share the use of design thinking in career development, a user-centric approach, and are implemented as university courses, they differ in their specific focus, target audience, and unique features. BEAST is tailored specifically for students and emphasizes personalized career development during the course of study. It also considers the needs of university teaching staff, Career Offices, and university management staff. On the other hand, DYL has a more general audience and explores design thinking in the broader context of career and life development.

Theoretical Background

With future graduates entering a world where job transitions are more common, career paths are less predictable, and employment prospects are more fluidly defined (Savickas et al., 2009), design methodologies can be applied to provide a structured framework to foster this stage of transition (Dorst, 2011). The contribution of design to modern society is becoming increasingly important, redefining its areas of action. Life Design is one of the areas of design usage that has emerged within the last years and refers to a specific type of counseling that assists individuals in defining their career as a story, narrating their personal working lives with continuity and coherence, discovering life themes, creating life meaning, building identity, formulating adaptive actions, and pursuing the life that is expected of individuals (Savickas & Pouyaud, 2016; Venter & Maree, 2020; Wong, 2021). This innovative design approach and its application in life is a product of the insecurity present in the labor market caused by the information age. Life design encourages workers to become lifelong learners who are proficient at using cutting-edge technology, value flexibility over stability, keep their employability, and create their own opportunities. These new ideas about the workplace highlight that an individual's career is a personal matter and is independent of their employer (Duarte, 2004).

By applying Positive Psychology practices and a Design Thinking framework, this study serves as a compass that continually reflects the student's ongoing professional development path, assisting them in the academic and personal growth. More specifically, this study uses the Innovation process and learning styles Framework described in Beckman and Barry's (2007) study to consider how each method incorporates the key aspects of the Design Thinking learning process and which tools and techniques are used.

The primary objective of both methods is to increase students' understanding of personalized professional development by developing a connection between their identity, beliefs, and actions. This is accomplished by offering a structured process consisting of a set of tools that allows university students to discover what best fits their aspirations and possibilities before entering the professional world.

The use of design and business techniques previously utilized in the innovation industry as part of career orientation is a notion that has been present for several years. The primary purpose of Design Thinking is to modify one's perspective on a problem by emphasizing correctly describing the problem and encouraging the shifting from a fixed mindset to a growth mindset. Since its employment led to the development of many innovations, Design Thinking has become a key component in the strategy of many companies, awakening a recent interest in employment and educational management (Boland & Collopy, 2004; Starkey & Tempest, 2009). Design thinking methodologies can be adapted and utilized in career planning and decision-making. Design thinking's user-centric approach can help individuals better understand their skills, interests, and values, leading to more purposeful career choices.

Methodology

To conduct this study, we analyzed the Design Thinking based career development methodologies that are implemented in University courses and have a supporting book. This resulted in: "Designing Your Life" by Bill Burnett and Dave Evans (2016) and "Empowering Students' Awareness for a Personalized Career Development. An Approach to Discover, Experiment, and Learn" by Guerci, Eric, Joanna Świętoniowska, Maria José Varadinov, and Matteo Vignoli (2022).

To compare the process and tools, we used Beckman and Barry's framework (2007):

- **Observations:** When it comes to designing your career, the first phase of the process is all about understanding your own needs, problems, and lifestyle in a specific context. Analyzing job market demands, skill gaps, and industry trends can guide individuals toward viable and promising career paths.
- **Frameworks:** Even the best design in the world can't solve every problem for every person all at once. A key part of the design process is defining exactly what issues it's important to address. In career design, this phase is about defining what are the principles and the elements to align the personal work identity with the job market.
- **Imperatives:** The "ideate" phase of the process is the part that most people imagine when they think of design thinking. In this phase evaluating multiple career options increases awareness and reduces decision biases. the importance of seeking feedback from mentors, peers, and industry professionals during the career development process. User testing helps individuals refine their career strategies and adapt to changing market demands.
- **Solutions:** In the prototype phase, you take your ideas and turn them into something tangible, trying out potential careers. This allows individuals to gain hands-on experience, test potential paths, and gather valuable insights to make informed career decisions.

Then, we performed a qualitative comparative analysis reporting evidence of similarities and differences (Ragin, 1987). From the literature, we identified the most relevant variables and assessed the two methodologies on that.

Design Thinking in Career Development

Designing Your Life

“Designing Your Work Life” by Bill Burnett and Dave Evans can be categorized as a self-help book targeting individuals who are looking to enhance their career satisfaction and design a fulfilling work life. The book utilizes a design thinking approach, providing readers with practical tools and techniques to identify their strengths, explore new possibilities, and navigate career transitions. The key concepts revolve around reframing one’s mindset, experimenting with different options, and learning from failures. The book incorporates case studies and real-life examples to illustrate its principles. In terms of structure and tone, it is organized in a systematic manner, guiding readers through a step-by-step process, and maintaining an encouraging and supportive tone throughout.

The DYL methodology uses the standard Design Thinking Phases, as it is possible to see from Fig. 1, from Burnett and Evans’s lectures.



Fig. 1
DYL Process. Adapted from Stanford’s lecture slides.

The following table presents the main tools of DYL methodology, mapped with the framework of Beckman and Barry (2007):

Tab. 1
DYL Tools and Phases.

FRAMEWORK	DYL PHASE	TOOLS
Observations	Accept Empathize,	AEIOU: observe the context to effectively to discover specifically what it is that is or isn’t working. Life View: Conducting interviews to gain insights into people’s experiences and aspirations. Good Time Journal: Keeping track of daily activities and identifying moments of engagement and fulfillment.
Frameworks	Define	Workview: Defining your personal values, motivations, and interests related to work. Reframing: Challenging assumptions and reframing problems to generate new perspectives.
Imperatives	Ideate	Mind Maps: Visualizing and exploring various ideas and possibilities. Odyssey Plans: Exploring multiple potential career paths and imagining different futures.
Solutions	Prototype, Test	Prototyping Conversations: Role-playing conversations and testing different approaches in real-life situations. Life design interviews and experiences “Wayfinder” Tools: Practical exercises and frameworks to navigate career transitions and decision-making. Failure Immunity: Cultivating resilience and learning from failures. Small Bets: Taking small, low-risk steps to test and validate ideas.

DYL was developed initially as a class at Stanford, and it is now a global phenomenon with classes in several universities, an online MOOC, and certified coaches offering workshops in organizations and institutions.

The BE(A)ST Approach

“Empowering Students’ Awareness for a Personalized Career Development: An Approach to Discover, Experiment, and Learn” by Guerçi, Eric, Joanna Świątoniowska, Maria José Varadinov, and Matteo Vignoli primarily targets students and educators, aiming to empower students in their career development journey. The book introduces the BEAST approach that emphasizes self-discovery, experiential learning, and continuous experimentation. It focuses on developing students’ awareness of their interests, strengths, and values, and encourages them to actively engage in various learning activities and explore different career paths. It integrates DYL and Business Model You, together with other innovation and business tools. All the elements of the BEAST approach help young people in four key activities: finding personal resources gaps, career development, revising plans, and redesigning the career path if needed. The book incorporates tools and techniques such as self-assessment exercises, reflection prompts, and action plans. It also includes case studies and examples to provide practical insights. The book’s structure is designed to guide students through the process of personalized career development, and the overall tone is informative and educational, aiming to inspire and guide students in their career exploration.

BE(A)ST is a collection of 21 tools and techniques, such as daily exercises, rituals, reflections on thoughts, feelings, and beliefs, and a thorough career and life plan. As mentioned above, the main objective is personalizing the learning path leading to professional development. BE(A)ST is distinct in the four following stages: *Self-reflection*, *Professional identity definition*, *Career scenario exploration*, *Career prototyping and testing*. In each of these stages, each student profile has the opportunity to receive a set of carefully chosen tools and strategies to meet their personal needs (Guerçi et al. 2022), as it is possible to see in Fig. 2.

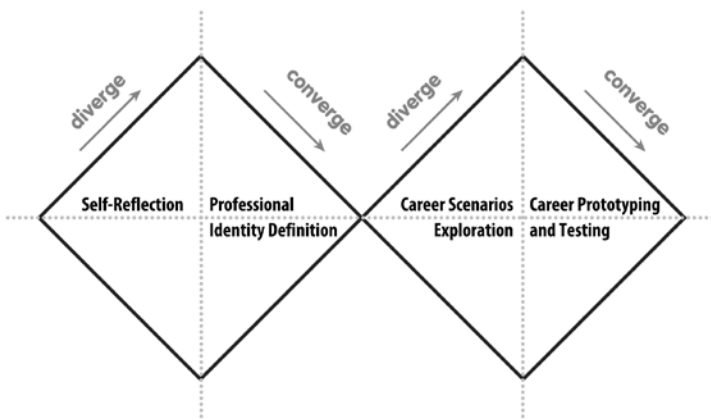


Fig. 2
BE(A)ST approach.

In the developed course, Design Thinking is utilized as a framework for customized tools/techniques in the BE(A)ST approach, and it gives instructions on how to apply them during the framework's fundamental stages. The main objective of using Design Thinking is to offer students an experimentation workbench that allows them to produce a variety of prospective career routes from which they may choose, design, test, and apply for professional growth. Going into detail about these four stages:

- 1 *Self-reflection*: This stage focuses on the work and life view of the student and aims to deepen their understanding of what is really meaningful for them. This is an empowering process, where students are encouraged to self-reflect and discover their skills, attitudes, core beliefs, values, and interests, using the many tools available in their tailored path.
- 2 *Professional Identity Definition*: By evaluating the information gathered in the first phase, students better understand the professional life principles and personal resources and also assess their development.
- 3 *Career Scenarios Exploration*: Professional Identity Ideation brainstorming is used at this stage to assist students in selecting the professional identity that most interest them, taking into consideration personal resources and their alignment with the resources required for specific professions.
- 4 *Career Prototyping and Testing*: In the final stage, the student designs and evaluates a few career alternatives to better understand their opportunities. At this point, the student develops and tests the first prototype of their personal career path, which will be improved later depending on the feedback obtained during the testing phase.

Students are assessed and “matched” to a student profile that best represents their personality, interests, and needs, and on a secondary stage, are proposed tools that synthesize their personalized career plan. The evaluation of the student profiles is based on the four axes of student behavior regarding their overall level of career awareness and whether or not they act on it. More specifically, the four student profiles were categorized in terms of student career proactivity and student career decidedness (Guerci et al., 2022). In the figure below, the separation of each profile becomes evident,



Fig. 3
Student Profiles.

As demonstrated in Fig. 3, the four profiles are very different from each other and represent students at different levels of professional awareness and journey. Therefore, BEAST provides a tailored path for each of the four student profiles, including a set of tools to assist the student in each stage of the career design process: *Self-reflection, Professional Identity Definition, Career Scenarios Exploration, Career Prototyping and Testing*.

FRAMEWORK	PHASE/ STUDENT PROFILE	A	B	C	D
Observations	Self-reflection	Life Dashboard, Talent Identification, Well-being compass	Change of Perspective Good Time Journal External Observer Life Dashboard Well-being compass	Career Mind Mapping Life Dashboard Role Identification	Career Mind Mapping Change of Perspective
Frameworks	Professional Identity Definition	Design Life Principles, Identify your values, Talent Identification	Design Life Principles Set Goals	Career Mind Mapping	Design Life Principles Career Mind Mapping Role Identification
Imperatives	Career Scenarios Exploration	Decision Tree, Odyssey Plan	Odyssey Plan Rich Pictures	Career Mind Mapping Odyssey Plan Personal SWOT Matrix	Career Mind Mapping
Solutions	Career Prototyping and Testing	Personal Business Model Canvas	Failure Reframe Personal Business Model Canvas Support Circle	Career Mind Mapping Change of Perspective	Failure Reframe Personal Business Model Canvas

As Tab. II indicates, for every student profile there is an average of two tools/experiences proposed at each stage of the exploration journey. Completing the personalized paths may take from a week to several months, according to the pace of each student and the format they choose to follow/ is offered at the higher education institution they attend. By the end of their personalized path, students should have developed personal awareness, a greater understanding of their career possibilities, desires, skills, and talents, as well as at least one (or, in some cases, multiple) action plan(s) outlining the steps they need to take to achieve their professional goals as well as a personal business model which is the final artefact for every student profile.

BE(A)ST was developed to be implemented by higher education institutions and therefore was established in a course format that can be offered as a separate compulsory or elective course within the study program. For this course, learning outcomes are defined and verified using the appropriate methods, and students realize these outcomes throughout the entire semester or year. The University of Modena and Reggio Emilia (UNIMORE), the University of Information Technology and Management (UITM), and the Polytechnic Institute of Portogruaro (IPP) are currently offering the BEAST course.

Tab. II
Tools corresponding to the personalized career path of each Student Profile. Adapted from Guerici et al. (2022).

Results

The two approaches share common elements in promoting student

engagement and active participation. Both approaches emphasize the importance of self-reflection, collaboration, and setting clear expectations. DYL, however, is a plain application of Design Thinking to Career Development, while the BEAST approach is student-centered and aims to empower students in their learning journey. The BEAST approach assumes that professional development should be based on prototyping, testing, and revising rather than planning and following long-term plans and should be focused on professional identity rather than on specific job position(s). Both approaches can complement each other in fostering creativity, critical thinking, and problem-solving skills in students. These methodologies emphasize the importance of finding purpose, aligning personal values with professional goals, and using design thinking to uncover a deeper understanding of career-related challenges.

By following the principles of design thinking, individuals can actively shape their career paths and make informed decisions about their professional lives.

METHODS	SUGGESTED TOOLS
Designing Your Work Life	Reflection exercises, mind maps, time audits, career dashboards, prototyping, storytelling, reframing, and design thinking personalized tools like the Odyssey Plan.
Empowering Students' Awareness for a Personalized Career Development	Self-assessment tools, reflection exercises, career exploration activities, goal-setting worksheets, experiential learning opportunities, study program analysis, prototyping, and testing exercises (e.g. with Personal Business Model Canvas), industry research, mentorship programs, and networking exercises.

Tab. III
Tools comparison.

Both methods offer a range of practical tools to help individuals in their career development journey. "Designing Your Work Life" focuses on using design thinking principles and tools to design a fulfilling and meaningful career, while "Empowering Students' Awareness for a Personalized Career Development" provides students with self-assessment tools and activities to explore different career options and develop their skills.

Here is a table summarizing the main similarities and differences between “Designing Your Life” and “Be Aware Students”.

Method	“Designing Your Work Life”	“Be Aware Students”
Main Focus	Designing a fulfilling work life	Empowering students for personalized career development
Target Audience	Students and Professionals seeking work-life balance	Students and educators
Methodology	Design thinking principles applied to career development	An approach involving discovery, experimentation, and learning based on Design Thinking, Effectuation, and Business Model Thinking
Key Concepts	Career design, reframing challenges, prototyping ideas	Personalized career development, self-awareness, experimentation
Approach	Practical, hands-on, action-oriented	Experiential learning, reflective practice
Benefits	Enhanced work-life satisfaction, improved career outcomes, improving job satisfaction	Increased self-awareness, informed career decisions, personal growth, redesign education path if necessary
Tools and Techniques	Design mindsets, ideation, prototyping	Self-reflection exercises, experiential activities
Case Studies	Real-life examples from various professions	Examples from students' career journeys
Structure	Organized into chapters with exercises and activities	Sequential/iterative approach with clear steps, checkpoints and tools
Overall Tone	Engaging, conversational, encouraging	Educational, informative, supportive

Discussion

Tab. IV
Methods comparison.

This works focuses on a comparison of two leading methodologies that apply Design Thinking to career development. In fact, both methods emphasize the application of design thinking principles in the context of career development. They advocate for a user-centric and innovative approach to shaping one’s professional journey. Both aim to empower individuals in their career development. They encourage readers/students to experiment with various options, gather feedback, and make informed decisions to create a fulfilling career path. The authors recognize the importance of personalized career development. They encourage readers/students to discover their unique strengths, interests, and aspirations to tailor their career choices accordingly. They acknowledge the significance of continuous learning and growth in the career development process. They advocate for an iterative approach that allows individuals to evolve and adapt based on new insights and experiences. They all offer practical exercises, tools, or frameworks to facilitate the application of design thinking principles to career development. They provide readers/students with actionable steps to implement in their career exploration journey.

Differently, DYL targets a general audience, including professionals seeking to improve their work-life balance and find greater fulfillment in their jobs. In contrast, BEAST is specifically tailored for students, focusing on personalized career development for those in an academic context. While both methods apply design thinking to career development, DYL primarily focuses on work-life improvement, whereas BEAST concentrates on the holistic development of students’ careers. The context of career development varies between the two methods. DYL addresses the challenges

and opportunities individuals encounter in their existing work roles, while BEAST explores career development at the early stages of a student's academic journey.

In summary, both methods share a focus on design thinking in career development, but they differ in their target audience, scope, context, and depth of research. DYL caters to a broader audience and concentrates on work-life balance, while BEAST specifically targets students and provides insights into personalized career development in an academic setting.

While we have no information on how DYL was developed, BE(A)ST is a product of the design process using an abduction mindset (Dorst, 2011), proposing its methodology as a solution to the newly identified problem institutions and students of higher education face. This innovative approach stems from the realization that students need to be “equipped” with a set of tools that will enable them to recognize their strengths and strategically design their professional paths in light of the emerging challenges and fluidity in the professional world brought on by the VUCA world. Although the created course combines elements of the Management and Design literature, BE(A)ST differentiates itself, as it adds the component of personalization, validating Design practices in an academic context and addressing its significance in higher education.

B(E)AST encourages students to better design their careers by increasing self-awareness and pushing them to probe and validate new university courses, extracurricular activities, and career options. In a sense, this approach provides the framework for this continuous process of professional development discovery. Having acknowledged that “one size fits all” standardized testing, such as the SII (1994) — which adopts a mass-market approach to career planning — cannot create relevant solutions that fit human needs, the study team focused on design strategies to personalize career planning, B(E)AST approaches each student as an individual with their own needs, struggles and strengths, and leads to the design of a personalized career plan. The findings revealed that there is no universal obstacle that students face in career decisions/design, nor a universal student profile, as each student has their own personality and ambitions. Therefore, the study team felt compelled to establish a representation of these many “types” of students, which led to the construction of four international Student Profiles. This was considered the first reframe of the initial problem, from “how might we help students to be better prepared for their future professional life” to “how might we help different types of students to be better prepared for their future professional life”. Considering personalization, we can conclude that BEAST is an evolution of DYL.

Last but not least, another important aspect is the scalability of these approaches. Universities can employ BEAST and DYL as an alternative to traditional “one on one” and “one size fits all” career counseling by helping students to help themselves. Therefore, fostering career awareness is at the core of this methodology, making its practice sustainable for students to follow and possibly, revisit some stages of the approach throughout their professional careers. Nevertheless, offering personalized support and guidance to young students is an inextricable component of every educational institution that invests in the quality and sustainability of its foundation.

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Conclusions

This analysis opens the way for further studies extending the integrated framework for students' career development at university. The main objective of this work is to rethink how career planning is addressed in the present educational system and to propose new, personalized and more efficient methodologies design based. Indeed, the design thinking methodology is at the core of the reflection and construction of the approaches by enabling the authors to propose practical and empirically validated tools to guide students' career development.

DYL and BEAST enable students (and career advisors) with original toolboxes and strategies that allow them to focus on the process of choosing a profession, while also emphasizing the social responsibility to educate young citizens on how to pursue their professional paths. In fact, as long as it is not only focused on employability criteria, career counseling, and awareness are important aspects of bridging the gap between higher education and the workplace. When seen as a process that requires strategic planning, assessment, staff professionalization, and a commitment to comprehensive education, career assistance in higher education is crucial in immersing students and graduates in their own personal and professional development to benefit their communities.

Because the established techniques are multifaceted, they may be employed by university stakeholders and Teaching Staff members, University Management Staff, and Career Offices. In fact, Design Thinking Career Development methodologies are a valid investment for universities willing to orient their students in designing carefully and proactively for their careers. The flexible course format can be easily implemented, providing higher education institutions with versatile and effective training offers for personalized career guidance to a large-scale audience.

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Design Processes: From the Historical Perspective to the Application in Startups Companies

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Abstract

This article addresses innovation, entrepreneurship and design management, aiming to investigate how it could contribute to the maintenance of the innovative character of startup companies. A brief survey was made on the importance of design in organizations. The timeline with the main developments from the 1950s to the present day, revealed that design has been strengthened as an entrepreneurial and strategic character. Subsequently, the Brazilian startup scenario was structured, analyzing the context in which they are inserted, as well as their management paradigms, which culminated in the search for information about design management and its role for the innovation of organizations. As a result, the theoretical studies allowed the elaboration of a model with five processes: Design for innovation strategies; Design for idea generation; Design for concept creation; Project to represent the company; and Design as an integrator.

Keywords

Design process
Startups
Design management
Innovation

Introduction

It is interesting to observe the evolution of the field of design to the present day, to understand the importance that this area is associated with the innovation of organizations. Bonsiepe (2015) states that in recent decades, the concept of design has undergone significant changes. In defense of design as an innovation process, the author clarifies that the project is a “constitutive element for the general innovation process” and not a peripheral element. Technological innovation in design is approached in different ways.

The first, more generally, involves a system of guided basic research, process and product development that incorporate new technical, functional or aesthetic solutions, in addition to their introduction into the production system.

The second interpretation, more restricted, refers to the last phases, in which the application and technological revisions are present. As a technological activity, design should not be limited to the last stages of a product’s development, but should have a proximity to research to adapt new technologies to products or improve products already on the market.

Currently, the detachment from the classic view of design, for this contemporary perspective, design expands its field of action, reaching levels of management, not as a process, but in the broad sense, as a guide to the innovation management process of an organization.

In this sense, design is considered an important element in the universe of innovation and entrepreneurship, no longer restricted to the aesthetics of products, which even corresponds to an inadequate discourse for such importance and relevance, which the area finds itself, but focuses on an ideation process that aligns business needs, such as strategies, creativity, resources, with market demands and opportunities, to ensure user satisfaction as well as company profitability (Martins & Merino, 2011).

In the universe of startup companies, according to Martins & Merino (2011), support and the ability to compete are necessary, which increasingly depend on the innovation process. This condition becomes more complex, thanks to the incipience of a business model that remains innovative over time or that the idea in question originates a really new product or service.

The design management area presents itself as a recent, current and appropriate approach to make startup companies agile and scalable. It is being disseminated in the management universe of organizations as a way of involving the company’s people in search of creating an offer of really considerable value, as it helps to structure and design its environment to make it understandable.

The realization of the proposed research is justified primarily by the themes of design management, business innovation and entrepreneurship, whose dissemination in the academic environment is recent, since the presence of design as a participant element of business management and fostering innovation in companies is still configured as a still emerging issue in Brazil.

Startup companies around the world have been widely recognized for their high levels of technology, methodological design process and products and services considered innovative not only

at launch, but remain innovative in their existence. This is the case of companies, initially startups, today large companies, which were important for the recognition of the area as fundamental for innovation in organizations. Companies such as Google, Apple, Space X and Tesla are examples of solid organizations recognized as pioneers in design management and innovation.

The present article carried out an immersion in the triad — innovation, entrepreneurship and design management — and how this universe can be applied in startup companies, through a qualitative approach, so that they can maintain their innovative competence over time, through the processes of design. Therefore, it was necessary to deepen the bibliography that provide subsidies for the problem in question: How can design management processes contribute to promoting innovation in startup companies?

Timeline: The Importance of Design in Organizations

The importance of understanding this evolution is fundamental for understanding the context of design today and its relationship with the practice of innovation in the business world. This brief timeline is described below:

- From the 1950s: When the attention of the industrial world was focused on productivity, rationalization, standardization, they were responsible for promoting a rupture between design and art and for inserting it definitively into the reality of companies, being crucial for series production and the launch of new and affordable products on the market. However, it was associated with the cosmetics of the products, being restricted to the form, the look, the decorative features and the design.
- From the 60s: The first methodologies in design, mainly after the books by Christopher Alexander (“Notes on the Synthesis of Form”) and Bruce Archer (“Methods for Designers”), who were responsible for working the problems of design in a procedural way (Martins & Merino, 2011). However, this period was also characterized by radical criticism of consumerism, due to the large scale of industrial production, including the first manifestations of an appeal to a new culture of products.
- From the 1970s: Reality in antagonistic situations in the world between developed countries, whose focus was the production of cutting-edge technology, and poor nations, ravaged by misery and great social differences. It was characterized by the search for a design identity, whose socioeconomic contrast was responsible for the harsh criticism of design, regarding the form and function of products (Bonsiepe, 2015).
- From the 1980s: Questions about the social relevance of design started to lose strength, giving way to a motto in which everything in the area, before anything else, should be fun (Design for fun). The design of furniture products and lamps gained prominence in the market, with really valuable pieces and the resumption of the discourse on style and form (Bonsiepe, 2015).

- From the 1990's: The environmental issue and the importance of sustainable development involve design as an important element. Design management as a decisive factor for companies, whose reflections on efficiency and competitiveness resumed the discourses on the procedural practice of design in organizations. The recognition of social and economic importance stands out, however, it presented low relevance to theoretical issues and academic production in this context. There is a popularization of the term "everything is design", but also the understanding that design manifests itself in the invention of new real-life practices. In fact, the conceptual direction of the period contemplates design as oriented to the future and is related to innovation, which presents itself through the concerns and problems of a community and establishes a non-resigned connection, resulting in an effective action, revealed in products or artifacts with purpose and value to the human being (Bonsiepe, 2015).
- From the 2000s: The beginning of the century represented a period of changes in the way companies are managed, especially with regard to issues related to innovation. Maximizing the productivity of reengineering processes is left out in the current discourse on innovation (Liedtka & Ogilvie, 2011). Several disruptive products were launched, among them the iPod stands out, which was not just another portable music player, but in the way the music industry marketed its records, the increase in immateriality between the user and the product, as well as in the process of creating a network to provide a customer experience (Brunner & Emery, 2009). This example represents one of the main characteristics of the beginning of the century, in which the transformations of society and technological advances, post-globalization challenges and opportunities, in addition to radical innovations, as well as a new reality for the roles of professions linked to innovation: Engineers passed to be trained also thinking about business, administrators are prepared to lead technological innovation and designers are responsible for the entire product life cycle (Martins & Merino, 2011). With this, a new reality of project: from the previous, divided and the current, integrated and multidisciplinary:

As the center of economic activity in the developing world has shifted inexorably from industrial production to knowledge creation and service delivery, innovation has become nothing less than a survival strategy. In addition, it is no longer limited to launching new physical products, but includes new types of processes, services, interactions, forms of entertainment and means of communication and collaboration (Brown, 2009, p.7).

In this context, design is no longer an element only consulted at the end of product development, it becomes a function that involves an entrepreneurial and strategic character, far beyond the tangible, increasingly associated with services and experiences.

Startups: Concepts and Management Challenges

It is common for startup companies to associate with organizations that produce cutting-edge technology. Despite this conception, nowadays, its definition is much broader. The “boom” of companies of this size took place in the 1990s, thanks to the progress of Information Technology (ICT). This period, also characterized by globalization, the great territorial expansions of corporations around the world, as well as advances in bureaucratic hierarchies, from excessive organizational planning, which sought to mitigate business risks, startups gained strength navigating in the opposite direction of these organizations (Thiel, 2014).

Blank & Dorf (2012) state that a start-up company, linked to any type of business, that is not focused on the innovation of products or services and, therefore, exempted from the risks of uncertainties, are not startups. They operate based on the principle of interacting with other people, they are small in resources and motivated to build a different future, through new positions and ideas.

This new identity is due to the fact that very young companies reach the level of valuable, traditional organizations with a long time in the market. Previously, this lack of experience and wisdom would have kept most of these startups away from any possibility of success. This, however, no longer happens. One of the most important characteristics of these organizations is their rapid growth, in which the speed at which they stand out exceeds traditional, denser and slower organizations (Butler & Tischler, 2015).

It is important to note that, at the turn of the third millennium, still under the influence of the rapid evolution of ICT, many startup companies became known as “dotcom”. In general, they were ambitious and creative, offered high risks, differed from large corporations, for being unconventional, but used traditional management methods, as well as large companies. Despite the high values applied in investments, many of them lived intensely, however they died young (Butler & Tischler, 2015).

It is in this context that startups could no longer be defined by their cutting-edge technology, as well as their management methods following models that are applied in large organizations. In this sense, according to Butler & Tischler (2015), a startup is not the smaller version of large companies, nor even reduced models of small organizations. It can be defined as a temporary organization designed to pursue repeatable, scalable and profitable business models. Extending this definition, Ries (2011, p. 24) conceptualizes a startup as
a company or a human institution that is built in the most diverse fields and that spontaneously arises in a condition of extreme uncertainty, has in its essence the innovation to create products and services which intend to revolutionize the market.

Nowadays, the consumer environment is characterized by its high competitiveness, startup companies play an important role. Young entrepreneurs willing to take risks, with disruptive ideas and a lot of creativity, create completely new businesses that help to reinvigorate a country's economy. However, it is clear that the fact that a startup has a revolutionary idea is not a guarantee of sustainable success. Generally, these companies seek financing for their projects to become scalable and profitable.

As the startup market is characterized by uncertainty and also because they are completely new companies, there is no long and stable operating history, since they do not have statistics or experience, which makes them companies with a high risk of mortality in the first years of activity. The great challenge for these companies is to remain essentially creative not only in terms of innovation in products or services, but also in the company's management mechanisms. It is with this thought in mind that other business functions also become as important as the development of new products or technologies. A startup should not be focused on the product only, but on its market, competitors, users, suppliers so that true opportunities for innovation can be identified. For this, it is important to have a long-term strategic vision, with goals and targets set so that entrepreneurs have an instrument to guide their actions.

Brazilian Startups: Context and Management Paradigms

In developing countries, as the case of Brazil, the startups scenario is still nascent, but in fast growth. It is estimated that there are around 10,000 startups in the country, which in the year 2012 amounted to about R \$ 2 billion, which represents 0.4% of the Brazilian GDP (Nogueira & Oliveira, 2015). The state of São Paulo, followed by Minas Gerais and Rio de Janeiro, concentrates most of the country's startups.

From a financial volume point of view, the impact of these companies on the economy is still small, but these companies stand out by providing solutions that are not based on high technology but on social impact. In a study carried out by Dom Cabral Foundation in 2012, it was shown that the Brazilian entrepreneurs who had their companies discontinued hide behind a culture of intolerance to failure and leave that failure is a factor for the discouragement of entrepreneurship in Brazil. The non-acceptance to accept failure, besides being a cultural barrier to entrepreneurial development in the country, was responsible for a lack of knowledge regarding the causes of startup mortality in the country.

As a consequence of the entrepreneurial movement in Brazil, micro and small enterprises, which include start-up companies, have become important for the economy, since currently they constitute 98% of all the enterprises of the country represent 21% of GDP, besides 52% of regularized labor, becoming fundamental for the economic and social development of the country (Dornelas, 2016).

Another important issue is that startups are considered fragile companies in Brazil. One reason that leads to high failure rates can be justified by the lack of adherence of their products or services to the consumer market due to their limited ability to understand the environment in which they operate (Xavier & Cancellier, 2008). This reality reinforces the importance of the development of research oriented to better understand the context of startups. The concepts currently used to deal with management in these companies are scarce and require adaptations to a new entrepreneurial reality in Brazil.

Design Management: The Design Processes for Innovation

Mozota (2003) points out that the area of design contributes to success of an economy, it is related to the improvement of product performance, which increases the competitiveness of a country, and that every innovation, both incremental and radical, requires the participation of design. According to the author, research shows the relationship between business performance and design management, whose results prove to be better, than traditional companies, based on sales growth and profit rate.

Mozota (2003) states that design management is the effective distribution by the role of a manager and the available design features the company to contribute to meeting your goals. Mozota (2003) defines design management from different perspectives: As an end, that is, design is placed at the service of corporate objectives and as a means, in a way that contributes to the solution of management problems. He also says that design management is an “asset management” that adds value and coordinates resources in a balanced way, as well as an “attitude management” that supports the decisions of a company that contributes to its strategic value. Still, according to the author, design management involves the contributions of design that helps a company to develop its strategy.

Walsh (1992) apud Mozota (2003) highlights four characteristics of design as a process in organizations:

- Creativity: The design process results in the creation of something that did not exist.
- Complexity: The design includes in the process a lot of variables and parameters to compose the decisions and the activities.
- Commitment: Considering the balance of many conflicting variables, such as price and cost or materials and durability, looks for the best options for the harmony of the result.
- Ability to Choice: It is characteristic of the design process where people make choices in the many possible solutions to a problem, from the color, as well as the ideal ergonomics.

Mozota (2003) points out that the designers' performance is prescriptive, since they recommend a world that could be futuristic. Still, according to the author, the design process is a process of identity as it defines a company, its customers and investors, in addition to differentiating the organization and is at the center of its success. Every design process ends with a possible result, be it a product, service, packaging, experience. Is multidisciplinary and iterative character, far beyond the visual results, since it integrates market research, marketing strategies, branding, and production planning, among others. Finally, the design process is a knowledge process, which applies creativity, technologies and production methods to meet the needs of users and stakeholders, fosters innovation and entrepreneurial spirit in organizations.

In this sense, design processes aim for a unique result, as long as there is a problem to be identified first and then solved. Once identified this question the design process follows logical steps, which are applied in each phase of the project through techniques and skills, which together result in the success of the process.

According to Mozota (2003), the creative process in design follows five stages, they are:

- **Investigation:** A potential opportunity or need is identified and ideas are generated to see if this issue expands the field of research, and to better understand the problem. Results in a briefing, which includes the description of the problem and the project goal.
- **Research:** It evaluates the opportunity and importance of the project to the company and questions the stakeholders to better understand the data collected. Important issues such as product positioning, for example, aspects of the competitive market environment and project context are inserted in the project documentation. Results in sketch a diagram of the project, a script or settings on the project.
- **Exploration:** After understanding the problem in its entirety, this is the stage where the creativity of those involved is used without limits to draw sketches or other elements of the different possible forms. The result can be presented in different forms and perspectives. The result of this step is the selection of guidelines with key stakeholders.
- **Development:** Time to represent the solutions chosen for the selection of possible options.
- **Realization:** Related to the documentation of execution of a plan that contemplates the necessary for the solution of the problem in question.
- **Evaluation:** The stage responsible for the technical control, to guarantee the conformity of the solution in question. Market assessment is also carried out to conform the solution with the brand, target market and market objectives, for example.

A Proposal of Design Processes for Innovation in Startups

In this context, the theoretical studies addressed here represent an ecosystem that includes the disciplines of entrepreneurship, innovation and design, whose focus is the elaboration of a model that contemplates the understanding of the approaches presented through design processes, both to strengthen the design as a management tool as well as organize and present development activities to innovate through the design contribution.

Design for Innovation Strategies

The first is about design for innovation strategies, it is seen as a creative management process and aligns with innovation, through product, service or experience strategies, according to the mission, vision and strategy of startups. Participates in the improvement of developing process of new products, the definition of product strategy and the quality of work teams. It adopts a user-centered perspective that encompasses both a market-oriented view as well as a process of internalizing the information that is collected, both the internal and external environment, as well as the consumer market for the analysis of potential opportunities.

Design for Idea Generation

Another important factor in the management of innovation by design is the conscious and prospective research of the opportunities of the environment. The realization of an environment mapping, whose research encompasses many variables, such as cultural values, trend studies, evolutionary patterns contribute to the understanding of the problem and the search for solutions. Because of their observer profile and their questioning skills, through inquiries it is possible to generate ideas that can be integrated with the strategy to later become concrete. This process for innovation aimed at the management and selection of ideas is called design for generating ideas (Mozota, 2003).

Design for Creating Concepts

The third process, design for concept creation, establishes the development of new concepts of products or services adapted to changing needs as a consequence of transformations of possible ideas innovations or unique experiences for the user. It is the stage of formulating unique values of the product or service that will be delivered to the customer (Mozota, 2003). In this process, the practices of co-design and co-creation are fundamentals, since through this practice uses a global network of resources to create unique experiences together with customers and integrated into the process, which are key components for the generation of value and innovation.

Design for Company Representation

Another challenge for design management to foster innovation is the issue of design and company representation, since every product is a portrait of a company and the development process that created it. The way that work teams act, how decisions are made must all be coherent and related to their strategy. An organization that innovates through design must work with focus on the customer experience after consumption of the product / service. This process collects the market information to serve as input to the product life cycle improvements in an agile way (Mozota, 2003).

Design as an Integrator

Finally, design as an integrator, contemplates the activities related to the identification and consideration of customer requirements in all company functions. In other words, it is the adaptation of the product to its environment to provoke a "customer enthusiasm" for this to perceive the quality of the product and the company through its innovation (Mozota, 2003). The success of innovation depends on the integration of many tools, this process aims to keep everything and everyone integrated, in order to maintain a cohesive corporate image (Martins & Merino, 2011).

Final Considerations

Today's innovation is a critical need to maintain an organization's competitive capacity if it is introduced into a steady organization. This dynamic is fundamental for the construction of the central competence of a company and is related to the capacity to generate knowledge. The design is knowledge generator, so it is important the presence of this dimension in the innovation process of a company, continuously, in order to develop methods as well as flexibility in order to assimilate new knowledge in your development team, as results of application of the processes.

The literature review allowed the detailed study of the innovative entrepreneurship in startups, knowing the particularities and peculiarities of this type of business in Brazil. In this way, it was possible to emerge through research on the procedural practice of design, acting in the important dimensions of a startup. In summary, the five design processes are designed to act on:

- In creating the strategic plan of a startup, fundamental to the understanding of the opportunities in the market, the definitions and organizational goals and the definition of work teams.
- In the capacity to generate ideas, a process that encourages the whole company to propose new possibilities, opportunities, using creative processes to use in favor of their products, services and experiences.
- In creating concepts, the process aims to create new meanings, forms of use, payment models that stimulate the company to focus on radical innovations.
- In representation of the company, in short, is the way in which customers see the brand, the values, the products and services and perceive the corporate values at the moment of consumption.
- In the design integration to ensure a superior quality, consequently the success of innovation.

Finally, the processes presented here represent a compilation of recent theories that address design, entrepreneurship and innovation to contribute to a better performance of startups to generate products, services and innovative experiences. According Mozota (2003), successful companies see learning and improving their development processes as a part of business activity, whose goal is to continually learn how to do the activities the best way to more quickly and efficiently, resulting in a continuous capacity to produce competitive advantage.

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Design and Innovation: Where Do We Want to Play? Inquiry Into Some Design's Strengths and Weaknesses in Innovation

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Abstract

Innovation is a central topic in today's unstable economic conditions. Several disciplines are participating in this conversation, but what would design's role in this discussion? Designers with solid, productive thinking competencies developed around generalised horizontal skills could become central actors in this dialogue. However, design education seems to underestimate the importance of some business aspects of innovation. This study takes some evidence from an investigation with the Electrolux Professional's design and innovation team to discuss the gap between current organisational innovation practices and the strengths and weaknesses of the design in this context. The inquiry suggests a potential opportunity for design in the innovation field. However, to seize it, the design discipline needs to reconsider its traditional company role and straighten its business competencies to guarantee adequate cooperation in innovation.

Keywords

**Design
Innovation
Design thinking
Design management
Business**

Introduction

Since the end of the old century, innovation got increasing relevance within organisations. The rising market and business competitiveness and the general global crises jeopardised standard company strategy that identified innovation as a driver for new business growth (Lockwood, 2009). Over time, the innovation discourses become less academic and theoretical and more normative, aiming to understand the process of making an invention (Johansson & Woodilla, 2019). From this perspective, discourse such as lead-user (von Hippel, 1988), blue ocean (Kim & Mauborgne, 2005), open innovation (Chesbrough, 2006), and design thinking (Brown, 2009) took turns in a general hype around innovation.

In the literature, several examples observed the role design and design thinking played in innovation (Boland & Collopy, 2004; Liedtka, 2000; Owen, 2007). However, few adopted a designer perspective (Buchanan, 2015; Dorst, 2010). This paper aims to take clues from the Electrolux Professional case to discuss the educational implications for designers intended to work in innovation.

Methodology

This study moves its arguments from two primary sources. Firstly four semi-structured interviews, run in 2021, with the company design director and the innovation manager. They focused on the design department's journey toward innovation, highlighting the challenges the design department faced. Secondly, some broader considerations about innovation came from a study run at the end of 2020 that audited the company's executive team through thirty-two semi-structured interviews. This study deals with the meaning of innovation for the different company stakeholders, the obstacles that hinder innovation, and possible strategies to overtake them.

This inquiry does not aim to suggest any statistical correlation between the Electrolux Professional course of action and the design department's activities. No quantitative metrics have been collected for enough time to confirm this hypothesis. Moreover, no cross-industry analysis statistically confirms this generalised pattern of intent. Preexisting literature (Cooper & Junginger, 2009; Westcott et al., 2013) suggests this situation is recurring in organisations, but no data endorse that fact. The work's originality lies in the depth of the qualitative findings collected over three years of collaboration and participant observation. It represents an inspirational case that aims to make the design discipline reflect on its role in the innovation discussion.

Traditional Design Role

Electrolux Professional is a Sweden business-to-business (B2B) multinational company that produces professional appliances for the hospitality sector. Traditionally, the company and the industry paid sporadic attention to innovation, adopting a traditional and conservative attitude (M. Cadamuro, personal communication, 2021, March

4). However, in the new century, the innovation discussion started to take off, affected by the generalised acceleration of global competition. Electrolux Professional reacted to this shift by iteratively restructuring its innovation ecosystem, looking for the best-performing structure. Over this path, innovation leadership took turns between technical functions for almost two decades. After some consistent company reorganisation¹, the design and innovation paths came across, and the two parts progressively mingled.

Historically the design function assumed different positions in the organisational framework. Since its first introduction in the 1970s, it has moved under the marketing, industrial operations and research and development (R&D) departments changing and adapting its position in a liquid fashion. Under the marketing function (2000–2012), the organisation perceived the design function as a form provider connected with some functional aspects but still distant from the technical realm. Within industrial operations (2012) and R&D (2013–2020), the design role got more technical, supporting the R&D development effort by addressing the human-centred design (HCD) values in the project (M. Cadamuro, personal communication, 2021, March 4). Still, as the interviewee suggested, design contribution to innovation was mainly technical and bound to minor improvements:

In the past, we tried to help the product development by improving the product's interaction, ergonomics, aesthetics and overall experience. Still, we did not have the power to modify the concept radically. It was a limit because we could not act at the right level. Today, we are trying to challenge the product concept from its foundation. (D. Benvenuti, personal communication, 2021, March 11).

Design Thinking Turnaround

Since 2018, the design department's technical role has rapidly changed thanks to the excellent result of introducing design-driven methods in some pilot projects. The company's perception shifted when the design team used the design thinking label to support its innovation purpose. Interviewees underlined two ways design thinking legitimised the design role transition toward innovation. Firstly, as the innovation manager admitted, by straightening the design department's self-awareness to be a possible leading actor in the innovation discussion:

The Design Thinking movement awareness was vital for me. I had proof that the design could play a decisive role in innovation. Before, I believed in the connection between design and innovation, but I was overwhelmed by the other functions' knowledge. Design Thinking gave me evidence that designers could impact innovation. (D. Benvenuti, personal communication, 2021, March 11).

Secondly, as the design director noted, proving by doing to colleagues and decision-makers that the design thinking tool and methods² could strategically support and influence organisational decision-making:

1

In 2020 Electrolux Professional was split from Electrolux Group, becoming a separate company.

2

It introduced structured user research methods, facilitated collaborative creative conversations, and experimented with prototypes.

Design Thinking helped me and design to reach today's role because it proved to us that there are tools and methods that the company did not have and that the design discipline could offer to manage innovation in a modern fashion. [...]

The organisation's decision-making process was highly uncertain. Decisions were based on hierarchy, consensus-building networks, personal relationships and opinions. Design thinking puts the customer at the centre of the design decision-making process, giving it more structure and objectivity. (M. Cadamuro, personal communication, 2021, March 4).

Under this perspective, design thinking impacted the company culture at two levels: providing methods and tools to face the projects in a more collaborative and structured way (Liedtka, 2014) and reinforcing the design confidence and credibility in the organisation (Norman, 2010). In 2020 almost all the new projects embraced this approach, and in addition to the aesthetical and functional roles, the design department gained a new company position. It mediates the project requirement definition, working in a middle earth where business, technical and human needs should negotiate in a cohesive project vision.

Design and Innovation

In the design department role evolution, we can see a transition upstream of the company decision-making chain, dictated by the design's desire to have more impact on the organisational strategy Fig. 1. It started by influencing the product development decisions at the aesthetical and functional level to move upstream, where the briefing decisions define the project requirements. There, the design role got closer to the business and management realm balancing technical and business interests through a human-centred lens. However, its escalation moves further up, trying to build a new role inside the business realm.

As the innovation audit highlighted, the project strategy decision level, management and business actors usually plan the future projects the company will develop based on the present market situation, but this process has a central paradox. Innovative projects are intrinsically too uncertain to reasonably prove their worth to the stakeholders' team that needs to approve investments. Therefore, as the product and marketing vice-president argued, innovation will be strongly hindered if the company treats those projects with the same attitude as the product development ones:

If we try to innovate, we ask too many questions about pay-back, investment, etc. We are blocking innovation. We adopt a product development mindset asking for too many detailed unanswerable questions. In this phase, you have first to validate the concept. (U. Torsten, personal communication, 2020, October 15).

Roger Martin (2009), dean of the Rotterdam School of Management, has broadly described this contradiction. Organisations used to focus too much on exploiting the assets they already have by incrementally improving the competitive market position of their

portfolio instead of investing in risky but potentially rewarding innovative projects. In his work, Martin discriminates between exploitation and exploration. While exploitation is fundamentally essential to drive the core of the business and stabilise the company, a certain percentage of the company effort should focus on exploring new opportunities. In this regard, the management discipline turned to design-like models and design thinking to strengthen the company's exploration pathway (Boland & Collopy, 2004). Given the unavailability of readily accessible data about innovation, the best way to nudge innovation is by collecting early evidence of the consequences of the innovative hypothesis. The design's abductive and productive attitude of framing, reframing and exploring assumptions was a practical value for managers more used to an analytical mindset. In this role, design-like practices could synergically work with managers, exploring innovative ideas while collecting early clues of a possible future that the organisation can use to make the best decisions.

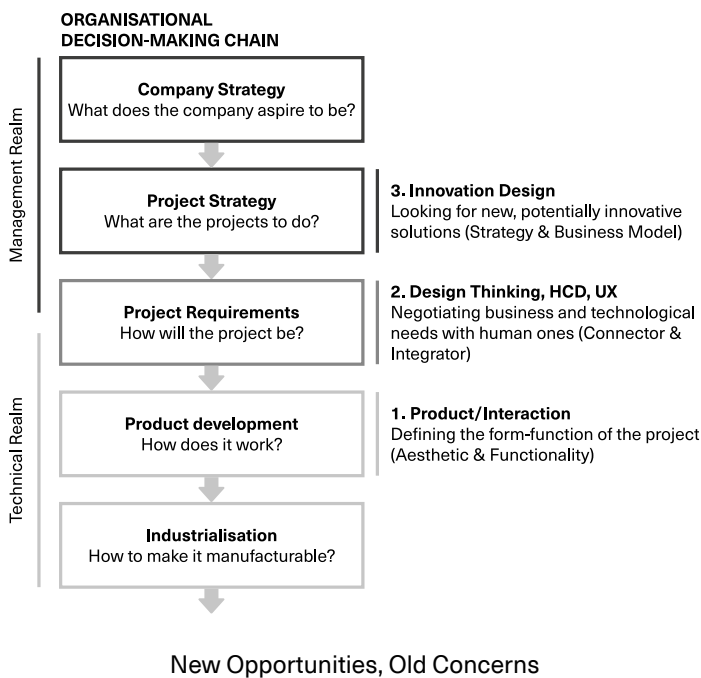


Fig. 1 Design role evolution in the Electrolux Professional decision-making chain. The model summarises the design department activities' influence on the Electrolux Professional decision-making chain, by Marco Limani.

Innovation is an essential topic for companies, but they seldom have a unique function focused on it. In innovation, the technical, business, and creative aspects require collaborative efforts and coordination. As the innovation manager suggested, the design has the potential to play this role, but it cannot be given for granted:

Today, the objective of the functions are: the business has to increase sales, the R&D has to develop and execute the business requirements, and the operations have to manufacture the R&D projects efficiently. Where is the innovation in this loop? I see the design role as constantly looking for new ideas and managing the best situation and the proper connection to let fresh ideas emerge. It supports the com-

pany and the business in foreseeing the most desirable direction. Each organisation has its leading innovation actor. The designer is not the only one who could play this role. Nevertheless, the design has its opportunity in this historical moment. (D. Benvenuti, personal communication, 2021, March 11)

Interviewees suggested that the ability to succeed in such a position depends mainly on two elements. Firstly it leans on the company's design cultural awareness level, which is context-dependent. To foster it, design managers must primarily focus on leveraging the design culture in the organisation, acknowledging that only the right degree can allow designers to achieve the desired company position (Cooper & Junginger, 2009). During the interview, the design director came back again and again to this point, pointing out his concerns:

The design department thinks wrong if it wants to be a solo artist. It has to read the context and promote the design culture, moving forward and sometimes backwards. We are an ethnic minority, so we need to adapt to the situation. Today we overtake the design as a style provider concept. We sized the digital, UX and innovation opportunities improving and increasing our team capability. Maybe we evolve too rapidly: few people perceived the recent transformations due to the slow company culture learning pace. (M. Cadamuro, personal communication, 2021, March 4).

A second aspect is the know-how needed to work upstream of the decision-making chain. In this context, there are few technical aspects but more business constraints, such as market size, distribution channels, adoption rate, potential markets, and new business and revenue models. At this level, as the innovation manager suggested, design and management work gets closer to entrepreneurship with all the consequences of the case:

In the past, the designers collaborated more with the technical side of the company instead of the business one. However, ignoring the market needs, price, and positioning strategy would like to negate a large part of the project. We need to know what Management Business Administration (MBA) courses teach to interact with the business world, and even more, if the designers want to play a role in innovation. Historically, design has evolved with technological revolutions, from the need to give a human shape to the technical output. This competence is still part of the design role today, but, from my point of view, there are always more cases where the design is getting closer to business, working side by side with it on innovation. (D. Benvenuti, personal communication, 2021, March 11)

Designers working in innovation have to face business jargon, design with business variables and be aware of business constraints. However, while designers at least got in touch with technical content and vocabulary in their education, the business information designers needed to work on business strategy is mainly new. The Electrolux Professional design team took time, support, and dedicated training to get used to them. For the Electrolux Professional case, the effort and the dedication seem worth the risk. In 2021, the "Experience Design Department" became "Design & Innovation", managing the overall company innovation responsibility by pushing and leading the innovation conversation.

In each organisation, the culture is different, and so are the stakeholder's biases toward design, the designers' skills, beliefs and goals.

Examples like the Electrolux Professional endorses what seems to be a global trend that shows designers have growing opportunities to work closer to business and innovation. However, will designers be willing to seize this opportunity? Moreover, if they will, will they be up to the expectations?

In the design discipline, scholars still debate the designer's identity and role in the organisation. However, as Buchanan had already observed (1992), the design's lack of specific subject matter made its practices challenging to frame. Thus, we should not consider design's role in organisations static because it will inherently differ in each context and change over time³. More discussion should focus on what the next role design could achieve and what it aims to become. The escalation of the Electrolux Professional's design department is an example of this. At first, their role was more connected to form and function; then, it was focused on technical aspects; finally, they put themselves as a fundamental partner for innovation, proving its value until reaching credibility. These shifts in conception did not happen by chance; the interviews showed the design department manager's willingness to lead this change, proving by doing the design capabilities and expanding the team skills along the path. The design department in Electrolux Professional still plays different roles. Still, it constantly looks for opportunities to develop its design practices in new and sometimes unexpected organisational realms.

However, any new context has its challenges. Designers working closer to the management strategy and business innovation realms face unfamiliar jargon and knowledge. A productive collaboration between disciplines seems possible, but the mutual effort to get along is paramount. Management discipline has already made the first step toward design, studying the potential implication for a design-driven approach to innovation and introducing lectures and seminary in the MBA courses (Dunne & Martin, 2006). This phenomenon brought design topics into the management discipline, educating a generation of future executives on design subject matters. Still, the design education commitment toward introducing the basics know-how of organisational systems, business operation, marketing, finance, and sales are rare and unstructured.

If management's interest in design is preparing a favourable company's innovation context, the matter seems to concern the designers' ability to work in such an environment. As the design thinking discourse suggests, designers still have strong capabilities that other disciplines recognise. For instance, the designers' productive thinking ability to frame, reframe and efficiently explore the consequences of vague and uncertain ideas (Schön, 1983). The reification capability of materialising abstract thoughts into tangible forms usable by others (Liedtka, 2000). The ability to manage different and various stakeholders through a creative process, supporting and fostering everyone's creative confidence (Kelley & Kelley, 2015). Finally, the ability to make deep connections among several signals and synthesise them into novel ideas (Collopy & Collopy, 2009). These capabilities are skills (Lawson, 1980), and as such, they require time, effort, and complete dedication to be mastered.

The designers' educational path, mainly structured on a studio-based learning model, is a perfect playground to master those skills and acquire a high degree of expertise (Cross, 2008). This know-how is still a competitive advantage compared to the management student briefly educated to design thinking. For this reason, even now that design thinking has become the public domain, good design thinkers are fundamental and still rare to find out (Rosensweig, 2011). Still, only vertical capabilities are insufficient to work in innovation competently. Designers must recognise the importance of business notions and techniques, use them if necessary and be able to dialogue with the many other disciplines involved in innovation. Otherwise, designers working in this new context will hardly fulfil the expectations.

Conclusion

The question comes back to the beginning: is design, therefore, design education, still interested in participating in the innovation discussion? If this is the case, some essential business and management knowledge should be offered to the new designer generation to overtake the linguistic barriers. If this is not the case, future management students will be, in any case, ready to bring forward the innovation conversation without designers, theoretically educated in design-driven approaches in their MBA courses. Design education has strengths compared to managers educated in design, but this will not grant designers a seat in the innovation conversation. It is not about design, business, management, marketing or technology; world complexity requires a holistic approach and the support of each discipline's vertical and horizontal capability to increase the innovation likelihood of success.

The opportunity is here; new executive-level managers will be more prone to see designers as business strategy partners, bringing design culture and value into the decisions room of the organisation. However, fundamental barriers exist to successfully overtaking and legitimising design in this role. Firstly the context-dependent culture readiness to accept the design discipline in such a role. Secondly, the capability to design in a business environment. While the first highly depends on the context and the design department's ambitions, education could address the second. For instance, why do we not widely introduce into the studio-based model the business aspects of the project to accustom students to the topic and teach them to use them to their advantage? Students should not perceive them as constraints or barriers. As Osterwalder (2010) showed, with the business model canvas, they can be design variables to help think creatively and support innovation.

The Electrolux Professional case shows that designers that feel at ease both with technical and business know-how can access plenty of new opportunities in the organisational realm. Adopting business tools and making students used to this topic is an opportunity for designers as the discovery of design thinking was for managers. However, only the right designers' willingness and skills to participate in this possible future could allow the design to be an essential ingredient for the corporate innovation discussion.

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Design Ecosystem in Portugal. Education, Research and Entrepreneurship

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Abstract

The article aims to frame the Design Ecosystem in Portugal, presenting data on education, research and employability in design, and identify possible causes for the still fragile connection between design and the industry. In Portugal, the extinction of the Portuguese Design Center, in 2013, exacerbates this lack of representation of design among companies, the public administration, and the general public, an space that is urgent to occupy. Oriented to observe, discuss, and think about the schools and research in design in the context of the national ecosystem, the REDE — Meeting of Design Schools presents itself as a sharing space for designing the future of Design Schools. The REDE started as an initiative of the Design Observatory in Portugal project of the ID+ Research Institute for Design, Media and Culture that aims to collect and interpret data from the Portuguese Design ecosystem to promote knowledge and influence public policies.

Keywords

Design ecosystem
Design education
Design research
Design-Industry collaboration
Critical and creative thinking

Gone are the days when Design was simple, naively proposing to solve problems, when it still considered resources unlimited and its prescriptive action essential to healing the world. The complexity of Design, today conditioned by sovereign sustainability, implies creating and proposing new problems to the citizens. Only by creating new problems will it be possible to guarantee the species' survival. Innovation is a consequence of research, but the relevance of research depends on the quality of the question that generates it. In other words, only creating new problems can imply innovation (knowledge is, after all, the ability to ask better questions — in a more informed way). Therefore, only the (industrial) capacity to create new problems for consumers will be able to promote the progress of consumption habits and, consequently, guarantee the leadership of the organizations that propose it, thus realizing the Design of the future. In this spirit, we propose to characterize the Design ecosystem in Portugal through the review of national and European documents related to teaching and employability; the impact of design research and industrial production on the economy; to identify possible causes for the still fragile connection between Design and the industry and to point out alternatives for more effective collaboration.

The National Board for Scientific and Technological Research (JNICT) was set up in Portugal in 1967, making relevant contributions to the promotion and support of national scientific culture, in line with the European reality and aware of its backwardness, particularly in relation to the United States of America (Decreto-Lei Nr. 47 791, de 11 de Julho de 1967, 1967). In 1997 this organism was succeeded by the FCT — Foundation for Science and Technology, a Public Institute whose mission is “the development, funding and evaluation of institutions, networks, infrastructures, scientific equipment, programmes, projects and human resources in all areas of science and technology, as well as the development of international scientific and technological cooperation”. (Fundação para a Ciência e a Tecnologia, 2020).

Education and Research in Design

The impact of (scientific) knowledge on the economic development of companies has led the European Commission to finance the integration of research and innovation through programs such as Horizon 2020 or the current Horizon Europe 2021–2027 with a scientific program based on three implementation pillars — Excellent Science, Global challenges & European industrial competitiveness and Innovative Europe (European Commission, 2019), thus acquiring more remarkable aptitude for global competitiveness.

The research strategy in Portugal is aligned with the European strategy and, analysing the country's financial effort in Research and Development (R&D) in the first 20 years of FCT - Foundation for Science and Technology¹ (1997–2016), there has clearly been an increase of more than four times in absolute terms and more than doubled as a percentage of GDP from 0.56% to 1.4% (PORDATA, 2020), but still met only about half the target set in the Lisbon strategy — 3% of GDP (European Commission, 2010). Portugal's results in the assessment of progress that the ERA — European Research Area published in 2018 report that

Cooperation between business and academia in Portugal remains low. Portuguese institutional framework does not include incentives or an integrated strategy to foster cooperation between academia and industry. The inefficient governance and finance systems of Portuguese universities when it comes to university business cooperation and innovation and the absence of large technology-intensive firms that might absorb more graduates from science and technology studies are also factors contributing to the issue. Furthermore, experience in the private sector is not valued and

academics have low incentives to follow dual careers or to engage in cooperation with industry. Recently a partnership between Innovation Agency and the business association for innovation (COTEC) was launched to encourage cooperation between academia and business. However, to date no concrete results were identified (European Commission, 2018).

In response to these timid results, the government has established the technological innovation strategy for Portugal for the period 2018-2030 whose objective is to

ensure Portugal's convergence with Europe by 2030, by increasing the competitiveness of the Portuguese economy, based on research, development and innovation, as well as on qualified employment conditions, together with increased public and private investment in Research and Development activities (Resolução Do Conselho de Ministros n.o 25/2018, 2018).

This willingness to assert Portugal in Europe through knowledge and innovation, with emphasis on the strategy of supporting and empowering the network of Interface Centres and Collaborative Laboratories, aims at greater dissemination of scientific results and success stories demonstrating the capacity of national innovation agents, motivating private investment in Research and Development (2/3 private expenditure to 1/3 public expenditure).

An investment that should not be ignored by companies, because, according to data from the European Commission for every €1 invested in research and innovation in the European Union, it generated a return of €13 in the business sector (European Commission, 2011), an investment that translates into innovation. However, Portugal is already innovative (one of the classification criteria is the integration of Design in the organization), appearing classified in the European Innovation Scoreboard among the seven strong innovators' countries and twelfth in the general table (European Commission, 2020). We think its ambition should be to position itself in the group of five innovation leaders, bringing the university closer to companies and better qualifying its workers.

Despite the reassuring promise of Design, almost 20% of unemployed people are registered with the Institute of Employment and Training (Portugal's public employment service), against almost 10% of unemployed graduates in other disciplinary areas (Friães, 2017). That indicates a lower absorption of graduates in Design or an excessive supply of this professional class to the market. It should be noted that the almost forty public Design schools of the University and Polytechnic system in Portugal are geographically distributed with representation in the Coast and Interior, North, Centre, South and Islands, which means that no region (with the exception of the Autonomous Region of the Azores) lacks training in Design.

In these schools, around 2,200 graduates in Design are trained per year in Portugal, including per year in the first, second, and third cycles. Of these, the number of those who graduated in the third cycle (2019/2020) and, therefore, more oriented to innovation, were 18 designers, which corresponds to less than 1% of the total number of graduates (Direção Geral de Estatística da Educação e Ciência, 2021).

With the aim of being constituted as a Portuguese Design Observatory, the research project DesignOBS Towards a Design Observatory: models, instruments, representations and strategies (led by ID+ Research Institute for Design, Media and Culture) proposed the collection and interpretation of data (currently providing 5 open access databases on the project's website, available at <https://designobs.pt/resources/>) of the Portuguese Design ecosystem, in order to promote its knowledge and influence public policies.

It was in this national ecosystem context, oriented towards an observation, discussion and distributed thinking about school, teaching, research and a professional practice in Design, that REDE – Design Schools Meeting was created. It is presented as a space to shape and design the future of Design Schools in Portugal and has already had three editions (Borges et al., 2017, 2019, 2021). Retrospectively, REDE#01 (University of Aveiro, 2017) assumed an exploratory approach and enabled a first diagnosis of the shared questions in the three thematic areas suggested to debate: education, research and transference / community. In the continuity of this inaugural meeting, REDE#02 (Polytechnic Institute of Cávado and Ave, 2019) opened doors up to the local agents and counted on speakers representing academia, industry and the local power and still with the international presentation of the Danish Design Center which, from the experience of articulating these agents, demonstrated the economic value of design. Keeping the spirit of active engagement of the design community, REDE#03 (Faculty of Fine Arts of the University of Lisbon, 2021) centered in the teaching staff the premise of a synthesized observation of the training context in design, a critical analysis and, finally, a general view on the future perspectives and improvement opportunities.

Economic Impact of Design

Different documents point to the need to develop Design metrics to collect data to assess its economic impact, thus demonstrating the strategic value of its integration in organisations (European Commission, 2013; Montréal World Design Summit, 2017).

The *Design Ladder Model* developed by the *Danish Design Centre* (2001) and widely spread in Europe, proposes mapping the use of Design in companies in 4 steps:

- STEP 1 NON-DESIGN — Design is not applied systematically;
- STEP 2 DESIGN AS FORM-GIVING — Design is used as finish, form-giving or styling in new products/ services;
- STEP 3 DESIGN AS PROCESS — Design is an integrated element in development processes;
- STEP 4 DESIGN AS STRATEGY — Design is a key strategic element in our business model.

The *Innobarometer* report (European Commission, 2016) — which presents the results of the survey of a sample of over fourteen thousand companies, including all European Union Member States, and Switzerland and the United States of America for comparative interest — focuses on innovation by identifying the profile of innovative companies, the problems of commercialising innovative goods and services, public support for innovative companies, future invest-

ment plans and, using the *Design Ladder Model*, the role of Design in company strategy in order to establish the future of innovation and its impacts. The report identified that in the average of the European Union countries 12% of European companies integrate Design as a strategic factor, 14% as a form generator, 18% as a process, and 56% of companies do not systematically integrate Design.

Portugal follows the average percentages of the European Union countries. The countries which most integrate Design in their companies are Austria (63%) and Switzerland (59%), while Portugal stands at 44% and, regarding step 4, Austria and Denmark stand out in equal percentages (21%), while in Portugal the percentage is 11% (European Commission, 2016, p. 97).

Observing these results, the information that Design has generated £85.2 billion (7% of GVA) in the UK (Design Council, 2018) gains paradoxical strength. *The Design Economy* report fits it with the evidence that Design is the ninth-largest employer, and the designers are 29% more productive and 23% more qualified than the average national workers. Radiography of the sector, favorable to evidence of significant economic impact, that Design Council has advocated, calculating that for £1 invested in Design, there will be £20 return in increased revenue, with a net operating profit of £4 (four times that invested) (Design Council, 2012).

The academia has been concerned with studying the relationship between Design and Industry (Agapito et al., 2015) and dealt with several events, not always with the desired success. Design presents itself as a partner of companies (it is in them that it takes place creatively). However, there is a specific resistance in this relationship.

Discussing this apparent dissociation between Design and industry, we find several possibilities of justification:

- 1 A prevalence for the subcontracting of industry in Portugal, working under the clients' Design, thus not working on its identity and not positioning itself through its own brand and product;
- 2 Difficulty in managing the critical and creative design workforce by companies, which is not retaining as many graduates as would be desirable;
- 3 The small size of most Portuguese companies and the consequent lack of means to integrate Design;
- 4 Design's inability to understand the corporate culture.

Also contributing to the lack of representativeness of Design among the national industry, public administration, and general public, the extinction of the Portuguese Design Center (in 2013) that developed an important work of valorisation of Design in the national and international context. A space that, in addition to schools and the individual initiative of professionals, urge to occupy.

However, the degree of intervention of Design in companies and its impact on the success of organizations has been studied over the last twenty years, giving rise to the discipline of Design Management.

In the evolutionary process of Design Management, we highlight 4 publications that have in common the staggering of different phases of Design integration in organisations, resulting from the Danish publication:

- 1 *Design Ladder Model* (Danish Design Centre, 2001);
- 2 *Design Management Manual* — Portuguese Design Centre / IAPMEI (Providência, 2008);
- 3 *Vertical design management in organisations* — PhD defended at University of Aveiro, ID+ (Noronha, 2017);
- 4 *Vertical design management in the territory* — PhD defended at University of Aveiro, ID+ (Ribeiro, 2021).

The *Design Ladder Model*, 2001, presents an evolutionary model on 4 levels, from the absence to the strategic function of Design in companies that, at the most basic level, focuses on the conformation of objects and at the intermediate level on the methodological process of its realisation. Similar to the Danish model, the *Design Management Manual*, 2008, reduces the steps to 3, associating each step with a historical incremental factor, starting with the *optimisation of industrial design production*, moving on to *good branding practices* as narrative coherence of production and considering above all *strategic anticipation* in the design of futures by service design and the creation of new problems. Proposing a 5th level which he called Academic Design (influenced by the researcher Dorst (2016)), Noronha, 2017 considers the intersection of design practice with academic research at the top of the pyramid. Finally, based on the imperative of vertical design management in organisations, Ribeiro (2021) applies the model to the territory, through articulation between the university (cultural mediation of design), industry (vertical design management) and the local authorities (territorial brand), in a holistic symbiosis of complementarities.

These 4 publications trace a diachronic process of evolution in design management, looking at the impact of Design on the economic value of companies, presents the scaling of three significant domains of Design integration. The first, primary, of production (production optimization); the second, intermediate, of communication (brand) and the third, superior, of strategy (management).

In its latest iteration (2021), Design Management saw the need to overcome a corporate scale, jumping to the territorial scale of the region (regional development), the country (national sovereignty) or Europe (European single market). Design started to consider the strategic dimension of the territorial brand, articulating the three agents of intervention on the territory for a knowledge economy:

- 1 *universities* through the production of innovative knowledge (scientific strategy), critical and creative anticipation of the future
- 2 *industry* through the production of competitive and memorable branded goods (commercial strategy), using new distribution technologies
- 3 *local authorities* through the management of the territorial identity, synthesised through the graphic brand (political strategy), supporting social cohesion and communicating territorial value.

Conclusions

In conclusion, when we ask ourselves what the ecosystem for innovation applied to entrepreneurship means today, we cannot fail to observe the imperative need for the articulation of domains through Design (ontological proposal of Design as a cultural mediator — (Providência, 2012), which go beyond industry, university and territory in themselves, in order to assert itself articulately as a *European territorial brand*. This condition of verticalising Design in territories and companies, prospectively and strategically oriented, will ensure the efficiency of Design within organizations, translating into economic growth and social prosperity (Ribeiro, 2021).

In line with Horizon Europe, the entrepreneurship ecosystem should focus on European industrial competitiveness under four significant objectives: 1. defense of industrial and intellectual property (technological sovereignty); 2. decarbonization of industries and energy efficiency; 3. promotion of the digital domain and its leadership; 4. stimulate the dynamism of the European single market. These four objectives reflected in the contribution of Design could mean a practice more focused on the Sustainability Program (United Nations General Assembly, 2015), Digital technology applied to industry, or protected authorship of the system of forms.

Nevertheless, of all the ambition with which Design can contribute to entrepreneurship, through the Program (functional destination), Technology (for sustainable production), and Authorship (conforming new ideas), we believe that authorship as a system of production of meaning through cultural mediation is, of all the contributions, the most relevant.

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The Design Posture: A Collaborative Learning-By-Doing Approach

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Abstract

In September 2021, Codesign Toscana¹ organised a pop-up school animated by a concept implicitly present in many design-related debates and around which our practices as an interdisciplinary collective have developed over the last five years: the “Design Posture” (hereafter DP). By relying on a collaborative design framework, we experimented with a cooperative learning approach using the urban context as a non-formal education platform and, following the direct experience of the pop-up school, named “Response/Ability” we discuss the possibility of new horizons in the urban context to organize educational platforms that rely on reclaimed city spaces and that generate insights for young generations.

Keywords

Design posture
Collaborative design
Nonformal education
Urban innovation
Response/ability

Introduction

The labour market of the European Union is increasingly described as precarious and defined by a growing percentage of workforce hired on temporary, part-time, or occasional contracts. Employers increasingly report how young people entering the job market either lack basic skills, or show too little experience for the position they apply for. The financial and economic global crisis of the first decade of the 2000s has progressively normalised this situation and the ongoing experience of the COVID-19 pandemic has further aggravated it. Most alarmingly, what we have learned from this prolonged period of crisis, is that young people (not only in Europe, but all over the world) are among the most affected individuals. Unless these vulnerabilities are promptly addressed, reads the latest ILO report *Global Employment Trends for Youth 2022*, “the high rates of youth unemployment, inactivity and insecure work could have long-lasting ‘scarring’ effects on young people’s career paths and future earnings’ and, at the same time, it could ‘undermine countries’ economic growth” (ILO, 2022, p. 226). In Italy, the issue is particularly relevant: in 2021 the country reported the highest percentage (21,9%) throughout Europe of population aged 15 to 29 who are not employed and not involved in education or training. By 2022, although data has dropped to 18%, the share of NEETS in the country is sMII significant if compared to the rest of Europe (the average percentage for EU27 is 10,9%).² Across OECD countries, Italy reports the highest share of NEET 18-24 (25%), compared to an average of 16.1% for the rest of the countries (OECD, 2022)³. In this difficult context, in which individuals (especially youths) progressively report helplessness in the face of events that they perceive as uncontrollable and independent of their will, processes of social and cultural innovation have the potential to re-open a horizon of possibilities; they can be considered, in other terms, catalysts to support individuals and communities on their path towards a renewed self-confidence and the feeling of empowerment that comes from participation and engagement. In this article, we focus on the experience promoted by Codesign Toscana and called “Response/Ability: a pop-up school of co-design and civic imagination” organized for youth under 29-year-old that took place in Prato (Italy). We describe the pop-up school methodology and the so-called “Design Posture” concept that animated the educational offering during the activities that we organized, providing a comprehensive literature review from the interception of different disciplines that sketches out their contours and the future perspectives that embed it further in the urban scenario, thus providing an educational space that takes the city as a platform for informal and cooperative learning that could offer insights for its participants.

1

Codesign Toscana is a cultural association composed of professionals and researchers interested in social innovation and design methodologies. Our activities unfold around design challenges aimed at imagining sustainable, resilient, and inclusive future horizons. We develop and help develop collaborative design processes by linking up citizens with public and private organizations.

2

Eurostat. Young people neither in employment nor in education and training (NEET), by citizenship [SDG_08_20A] https://ec.europa.eu/eurostat/databrowser/view/SDG_08_20A/bookmark/bar?lang=en&bookmarkId=4b920bfd-b2c9-4714-aaec-77a434e7a417

3

Furthermore, the share of NEET youth in the country who have been unemployed for 12 months or more is particularly high, at around 5% of more of all 18–24-year-olds (ibid, p. 52).

Learning Opportunities: Co-design and the City

The role of the urban contexts as arenas where the fragility of marginalised categories can be challenged offers us the opportunity to engage in design thinking and co-design practices as tools for self-realisation and well-being (Bertoni et al., 2016). According to Illich (2019) and, more recently, Marchigiani (2022), the city has been interpreted as the ideal platform to experiment with “wide-spread education practices” and convivial educational tools. Such literature on experimental pedagogy recognizes that fundamental learning “spots” are mostly found outside the schools’ doors. The urban context is identified, in other terms, as an occasion for learners to experiment with complex, multidisciplinary and concrete experiences; the place where an inexhaustible multiplicity of learning opportunities can be prepared, organized or simply faced. Authentic learning is activated and internalized only if mobilized by a “passionate attraction” (Fourier, 1971 in Mottana, 2008), by a desire, by interest, by curiosity; therefore, it is much more of an effective and rich experience when it occurs through project-based challenges and through co-design challenges with learners. It should not surprise that project-based learning (PBL) and co-design tools have increasingly acquired significance even in the most institutional educational contexts, contributing to lively discussions about its contribution (Almulla, 2020). Through co-design led, project-based and city-centered learning experiences, learners acquire greater awareness of themselves and of the “world”, they are endowed with tools and perspectives to orient themselves with respect to the choices that immediately await them, gaining skills, pragmatic sensitivity, reflective thinking, a stronger sense of agentivity and empowerment, perception of the context and its opportunities.

Methodology

Our main activities as Codesign Toscana have taken place in the city of Prato where, in September 2020, the City Administration launched a public call aimed at sustaining a reclaimed area repurposed to host co-working spaces and cultural initiatives. In the call, the authorities specified how the focus would be to enable the professional development of creative endeavours, and to foster the exchange of competences among local communities. Inspired by the above mentioned statements and a few reference that were later summarised in the concept of Design Posture, as Codesign Toscana members, we submitted the proposal for three days free-of-charged “pop-up school” thought for youths under the age of 29, who were interested in acquiring the principles of co-design theory, as well as in the possibility of collectively research and design in the contemporary city. The goal of the school was to enable participants to experience “Design Posture” towards the urban context through co-design. The Municipality of Prato awarded our proposal and we started designing our “Response/Ability. Pop-up school of co-design and civic imagination”, applied to the city of Prato. The design of the school program and offer underwent few different stages:

- Stage 1. A research phase kicked off the activities, and it was aimed at intercepting the urban challenges of greatest interest to the school's target participants. Qualitative inspired methods were applied in this phase mostly aided by interviews, urban ethnographies and desk research involving, among the others, representatives of the local educational community representatives (professional pedagogists, social workers), local politicians, administrators and local youths.
- Stage 2. Based on the insight that emerged in stage 1, a curriculum of the school was designed that identified themes, training modules, methodology, experts needed, and tools to be used during the pop-up school.
- Stage 3. A communication and engagement plan was conceived and applied.
- Stage 4. School activities were activated and delivered to the participants after having engaged in all the preparatory activities (logistical, methodological, programming).

As a result of the application of the above described learning design process, on 21 September 2021, Response/Ability kicked off with a roundtable where members of the collective Civic Wise Italia⁴ — were invited to discuss the multiplicity of challenges that designers need to face nowadays. Our guests started from the questions related to each day's activities to elaborate on our central issue DP: the posture that experts, practitioners, and individuals alike are invited to undertake and that is characterized by a mix of challenges and opportunities animating the desire to design. On the first day, the activities focussed on post-pandemic urban imaginaries, a topic that we addressed by reconstructing participants' experiences during the pandemic via cultural probes, which in turn were translated into metaphorical journeys towards an unknown future, using speculative design tools with the help of the artist Roberto Fassone. On day two, the attention shifted to the specific context of the city of Prato: the city has been at the centre of a dynamic process of metropolitanization, representing since the 1990s a gateway for global migration processes that have triggered the necessity to innovate the constant interrelation between diverse cultural impulses. Urban exploration tools have been used and unconventional city mapping techniques have been proposed by the collective Criticity. Lastly, on day three, city-imaging techniques were proposed to collectively co-design urban ecosystems to face emergencies derived from extreme climate conditions in Prato, using a) a project canvas realised under the tutorship of the environmental engineering firm IRIDRA (with which Codesign Toscana already established a fruitful collaboration — see Berni et al., 2022) and b) the inputs offered by the public art collective Circuito Urbano Temporaneo.⁵ On the last day of the school, local political representatives were invited to collect reflections, ideas and proof of concepts that emerged during the previous days of activity with the aim of activating an advocacy process with different urban stakeholders. Overall, 11 people in between Codesign Toscana team members and experts took part in the design, preparation and delivery of the school program. 25 people in between their 18-29 took part to the first edition of Response/Ability. Although not all of them officially identified themselves as NEETS many were neither employed nor officially in education by the time the school

4
A global network comprising professionals that work on urban regeneration projects and citizen engagement <https://civic-wise.org/>

5
Circuito Urbano Temporaneo (CUT) is a Prato based cultural association that investigates the contemporary world by means of the art, considered as an engine of awareness and regeneration, of aggregation and participation. <https://cutcircuitourbanotemporaneo.com/>

took place. Yet, they were all interested in acquiring experiences in urban research, communities' activation, social and relational design. These insights were collected via the submission of a pre and post-activities survey: "The school made me feel hopeful for the possibilities of a collective activation towards a common collective goal", commented one of the participants; "I analysed the design process from different angles. The most important, maybe, was the realization of the different temporalities inherent in the design process", writes another. Participants also enjoyed the effort to connect multiple debates and disciplines in the school; "[the school] taught me methods and strategies transversal to participatory design and some interesting critical insights into the urban", one writes, "It broadened my understanding and gave me some interesting inputs on research, communication, and design", echoes another.

Design Posture: A Tentative Definition

Before concluding, a step back is needed to sketch out the contours of DP: a concept that has somewhat represented the main learning outcome of the school and that has guided the design of its activities and the learning experience offered to the participants. As Codesign Toscana members, we have facilitated its emergence theoretically by triggering a discussion in the panel of experts, but we have also hoped that its coming into being would become part of the school participants' ways of conducting research and design in the city. The first challenge that has been considered when talking about DP concerns the pleasure and the capacity building aims that characterises the state of being designers. Nonetheless, this does not mean that designers are independent from the market dynamics: as any industry, design is increasingly looking at social impact and collaborative forms of innovation to gain market share and competitiveness, while public resources become fewer, and processes and team assemblies are increasingly dependent on speculative mindsets. As practitioners, designers, communities' activists, and members that focus on social innovation we therefore must ask how to preserve our agency in the formalisation and constant re-creation of the common goods.

The importance of maintaining a certain posture arises when designers act in territories and communities mainly by creating and *maintaining* relationships between heterogeneous social actors and agencies. Since the project is embedded in human and non-human ecosystems, services, and experiences both the maintenance of this system (namely its *legacy*) and the acknowledgment that the new communities we foster are crucial (see also Berni & Del Bono 2022).

DP stems from the ability to respond to a critical moment. Hence, it represents the ability to tune into a context and to have a commensurate response to the changes that affect it. Yet, assuming a certain posture before, or during, the design process, does not guarantee success. From a design research perspective, the failure of a project is design knowledge. In other words, failure is not failure, but it is also above all an extremely relevant factor. However, given that failure is hardly accepted by those who commission a "thing" (Björgvinsson et al., 2012) to design, DP also means to be self-reflexive in the design process.

Conclusion: The Relevance of Dp in Learning Design Practices Towards the Urban Context

Through the non-formal learning experience of Response/Ability, we intended to intervene in a context of change for vulnerable social categories, who experience disempowerment and disenfranchisement by generating a learning network brought together by the interest in social innovation and based on collaborative design. Formalising DP both theoretically and in practice is functional, in this context, to trigger a series of authentic learning and active citizenship dynamics that can facilitate the multiplication of spaces for inclusion, empowerment and innovation regardless of whether the service target is interested in undergoing a professional career in the design field or not. In designing the Response/Ability pop up school animated by the DP concept we build upon different design-related debates: first, we consider the idea of “design autonomy” developed by Manzini (2015; 2018), who underlines the importance of combining design with a focus on the local context by considering beneficiaries as active protagonists of the design process. The political-strategic value of design also lies at the core of the reflection on DP; therefore, in sketching out its contours a strong emphasis was put on the “meta-design” concept, theorised at the Ulm School of Design (physical and spiritual heir to Bauhaus), and the purpose of which is to bird-eye the project within a network of stakeholders. The idea of DP was also conceived as a “twofold positioning” (Guez, 2010), that simultaneously intertwines the observation of the phenomena taking place in a portion of time, space, more than human relationships and design practises. Finally, we borrow the idea of “design hope” theorised by Maldonado (1970), who traced important links between design and human self-realisation. Particularly relevant for us is the design processes that do not result in doing and that Maldonado calls “utopias” and which is premised on the recognition of an imperfect, yet perfectible world. While building a comprehensive bibliography connected to design-related literature, we encountered philosophical and socio-anthropological perspectives to be included in our on-going discourse: Haraway’s (2016) concept “Response-Ability”, de La Bellacasa’s intake on “care” (2017) and Sennett’s “Craftsman” (2008) have represented crucial elements in our elaboration of an educational program for the way in which they describe, respectively, a responsive relationship and a driving force animating our more-than-human worlds, and the condition of acting in self-renewing relationships. Along with the literature review, we asked the experts that we invited on the opening day of the school to brainstorm and iterate around DP, introducing the main ideas behind it. What follows is a brief schematization of the main ideas that came out of it.

DP emerges as a multifaceted concept with a slightly different nuance when discussed by experts or “practitioners”: the first group adopted a self-reflexive attitude towards their personal and professional life as designers for communities; the second one is more oriented in conceiving DP as a “mood” towards the community they work or live in and as a widespread sense of agency among people involved in design processes. From the Codesign Toscana

perspective, the reflection on DP, as the guiding light for a learning-by-doing educational approach pushed forward by a pop-up school, is prompted by a context of crisis and by the necessity to design to care and maintain relations. Differing from similar concepts already discussed in the design and organizational studies literature such as “design attitude” (Bason, 2014; Boland & Collopy, 2004; Michlewski, 2016), DP emerges in a blank space of possibility as a conceptual toolbox that needs further elaboration and enrichment; as a field where design and relational possibilities can be cultivated; as something that can be used as a discipline “glitch” (Russell, 2020) to foster debate, political and critical self and collective reflection, responsiveness and adaptation.

As a final remark of this new track of applied research for Codesign Toscana we highlight that, based on the Response/Ability school and the study on DP, we developed a transnational project proposal — between Italy and Greece — approved and funded by Erasmus+ -KA210 European funding scheme. The 1-year project, which started in September 2022, pursued several objectives that are reinforcing the building blocks of DP. Among them we could list: engagement of young NEETs in themes related to contemporary urban issues, climate change adaptation and social innovation; training of representatives of youth NGOs in collaborative design methodologies in order to replicate these in their internal educational and engagement processes; replication of the Response/Ability pop-up school in both Florence metropolitan area and Thessaloniki; lastly, monitoring, assessment and communication of the socio-cultural impact generated by the project. This first scalability test of the project, and in particular the Response/Ability pop-up school organized in July 2023 in Florence, has represented an additional research input on the future and strategic design trajectories for both Response/Ability and the DP concept. As a matter of fact, the methodology highlighted (see Section “Methodology”) together with the meanings associated with DP (see Section “Design Posture: a tentative definition”) have inspired the curriculum design, the selection of experts and the overall process design of the R/A school. At the same time, reinforced by the possibility of being hosted in LUMEN, a place born as an attractive hub for local associations and realities and an incubator of autonomous and sustainable economic dynamics, we recognized and set the basis for new applied-research paths that focus on the intersection between physical contexts in which R/A takes place, Design Posture’s conceptual background and learning outcomes arising from a collaborative and experimental teaching experience.

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Advanced Manufacturing for Sustainable Fashion. Developing Interdisciplinary Educational Experiences

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Abstract

As a creative industry with high cultural, social, and environmental impacts, Fashion is crucially demanding a paradigmatic shift through digital transformation toward a positive, sustainable change. Therefore, fashion education needs to nurture professionals able to tackle increasingly complex challenges, delving into technological systems and aiming at meaningful environmental, economic, cultural, and societal transformations. New learning paths, approaches, and tools should prepare future fashion designers with a hybrid set of skills placed halfway between design, technology, science, and arts. This paper presents the lessons learned from the Advanced Manufacturing for Sustainable Fashion (ASMF) module conducted at Politecnico di Milano (Design School) in the course Design for the Fashion System. While exploring digital fabrication and smart wearable technologies, students delve into prototyping activities aiming at reflecting on sustainability and fashion design practices' impacts. The paper describes the used learning tools and approaches and reports on instructional and pedagogical learning outcomes, problems, and future implementation of interdisciplinary educational experiences toward a systemic design paradigm.

Keywords

Fashion-Tech education

Skills gap

Sustainability

Digital transformation

Interdisciplinary education

Introduction

New Educational Models, Challenges, and Approaches for Future Generations

Sustainability, digital transformation, and resilience are the three drivers set for the European transition (A European Green Deal, 2019) toward better and more responsible futures where innovation should be guided not only by technological advancement but also by societal challenges.

In 2005, the United Nations pushed the HEIs to focus on education for sustainability in the curricula, research activities, physical operations, and student lifestyle (UNESCO, 2005). Therefore, the adoption of the 2030 Agenda for Sustainable Development has provided a favorable environment to scale up the implementation of Education for Sustainable Development (ESD) ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all (UNESCO 2020). Thus, ESD aims to develop skills to empower future professionals to reflect on their design actions, considering current and future social, cultural, economic, and environmental impacts, from both local and global perspectives (Ceschin & Gazilulsoy, 2016; UCLG, 2010). ESD pushes toward an interactive, participatory, and collaborative learning approach, a reflexive and action-oriented transformative pedagogy in a learner-centered teaching setting.

Besides, European efforts toward a digital education agenda are pushing a reorganization of learning activities for European citizens and professionals whose scope is the achievement of universal digital skills, integrating all subjects and disciplines with computer science and information technology (2030 Digital Compass: the European way for the Digital Decade, 2021; Digital Education Action Plan (2021-2027), 2021) in the upcoming years.

Higher educational institutions should undertake new educational models and approach to ensure that future professionals gain knowledge on what and how sustainability could be applied while driving the digital transition. Convergent education could widen and integrate disciplinary perspectives with the purpose of generating new knowledge to remain competitive in the work market (Hong, 2012). Besides, encompassing art and humanities (A), science, technology, engineering, and math (STEM) fields, STEAM education focuses on transdisciplinary learning processes thus allowing a broader audience of students and helping them see connections to the real world (Perignat & Katz-Buonincontro, 2019). Also, challenge-based learning (CBL) could support multidisciplinary educational approaches that encourage learning while solving real-world challenges (Nichols et al., 2016).

Fashion-Tech Paradigmatic Transformation

The fashion system has been invested by the transformation of Industry 4.0 (I4.0) (Schwab, 2016), combining its sociocultural and industrial roots with technologies such as the Internet of Things, Big Data and Artificial Intelligence, advanced manufacturing and digital

fabrication, virtual, augmented, and mixed reality, and collaborative robotics, thus allowing the generation of cyber-physical systems along the whole supply and value chains and aiming to completely change fashion paradigms (Alcàcer & Cruz-Machado, 2019). Few studies have tried to shape a framework of the Fashion-Tech potentials and criticalities/limitations in this paradigmatic transformation. Bertola & Teunissen (2018) defined Fashion 4.0 as a model of smart products, factories, and networks that affects fashion products, services, and processes toward innovation via decentralization, modularity, interoperability, real-time capabilities, virtualization, and service orientation. Focusing more on the digital craftsmanship of smart and soft wearables, Goveia da Rocha et al. (2019) highlight three main levels of complexity of the field: (i) product level through digital material production; (ii) service level through digital sensing and actuating capabilities that enhance garments' physical properties and end users' interactions and experiences; (iii) the system level allowing personalized design processes. Noris et al. (2021) and Nobile et al. (2021) focused on Digital fashion, classifying it into three categories: (i) Communication and Marketing strategies in the digital era allowing the development of systems, methods, and models for shopping experiences; (ii) Design and Production focusing on automatization and digitalization of practices, processes, and tools involved in product, services and systems' implementation along with new business models and improved decision-making processes through effective and efficient structured workflows; (iii) Culture and Society with implications of digital fashion in terms of culture, education, and societal development. Finally, ETP (2016) surveyed the impact of the I4.0 in the European clothing and textile industry framing three elements: (i) digitisation of products, processes, factories, workplaces, supply chains, distribution, and retail; (ii) sustainability, circularity and resource efficiency of materials, processes, and overall business operations; (iii) the proliferation of new business and consumption models based on the sharing of productive resources and final products, servitisation, pay-per-use or subscription models.

New Subject-Specific Skills in the Fashion-Tech Discipline

Encompassing social and behavioural sciences (e.g. psychology, sociology, anthropology, ethnology, economics, business, and management), natural sciences (e.g. biology, chemistry), engineering (e.g., electrical, electronic, informatic, mechanical, environmental) and science, the Fashion-tech paradigm could lead to open-innovation trajectories, deeply changing the industry, along with economies, and professionalism's skills, thus also impacting educational models (Bertola & Vandi, 2021). Therefore, hybrid learning paths and new pedagogical models along with interdisciplinary updated content are needed in fashion design education to prepare the future fashion-tech generations able to navigate the complexity of new sustainable and societal challenges, and respond to new market challenges, thus boosting professional employability and the innovation potential of the fashion sector.

Fashion-tech crucially demands training resilient and interdisciplinary fashion-tech professionals, equipped with a hybrid set of subject-specific skills placed halfway between design, technology,

and business management (Kalbaska & Cantoni, 2019; Colombi & Casciani, 2021). On one hand, the integration of digital fabrication technologies (DFT), intended both as an additive (e.g., 3D printing) and subtractive (e.g., laser-cutting) ways of prototyping/manufacturing products starting from 2D and 3D files does not impact only design practices and manufacturing processes, but potentially affects the development of innovative industrial models like digital craftsmanship, on-demand & bespoke production, and distributed manufacturing. Besides, smart wearable technologies (SWET), intending microcomputers and digital components integration into garments, have been already introduced in research activities, meanwhile struggling to be ready for commercialization (Park et al., 2021).

To properly deal with fashion 4.0 as advanced manufacturing technologies integrated into the fashion industry, fashion design students need to understand their logic and master their inclusion in fashion design processes, along with grasping their potential opportunities, and reflecting on critical implications in social, cultural, environmental, and economic terms. This holistic view reflects more on the complexity of current society. Contemporary DFT and SWET allow unexplored innovation trajectories but also raise several ethical and cultural questions, requiring a higher ability to envision their holistic impacts.

Research Methodology

This paper presents the lessons learned from the first and second editions of an educational experience about the integration of DFT and SWET in fashion design courses. The module *Advanced Manufacturing for Sustainable Fashion* (ASMF) has been conducted by the author at Politecnico di Milano AY 2020-21 and AY 2021-22 within the course *Design for the Fashion System*. The module is conceived to transfer instrumental abilities through intensive design experiences taking full advantage of digital technologies and reflecting on their impact on a positive change in the fashion system. The module is aimed to (i) familiarize the students with DFT and SWET while executing a group-based project, (ii) understand the impact of DTF and SWET in terms of sustainability, (iii) reflect on the potential of DFT and SWET in fashion design practices. The paper reports on the obtained results and future implementation of the AMSF module by describing (a) the used learning tools and approaches, (b) the instructional and pedagogical learning outcomes, highlighting interests and problems identified by the students, and discussing students' projects outcomes in relation to sustainability and innovation potential. The discussion aims to highlight winning approaches and reveal open issues that should be considered to improve the way fashion designers are educated when coupling their traditional training with DFT and SWET. The participants involved in the study are 35 (AY 2020-21) + 27 (AY 2021-22) international students enrolled in the second year of the Master's Degree in Design for the Fashion System.

Results are derived from the analysis of the data extracted from an initial qualitative and quantitative survey that was delivered to students to understand their entry skills. This initial information was compared to the students' reflections reported in their logbooks, where the documentation and critical reflections were collected

throughout the entire duration of the learning experience. Besides, the final projects were evaluated to understand the achieved level of maturity and learning outcomes.

Results

AMSF Module Structure and Goals

AMSF explores the world of fashion 4.0, focusing on DFT for the design and production of interactive fashion-tech garments and accessories that integrate SWET toward the achievement of sustainable fashion challenges. The main topics are (i) laser cutting and textile: software and methodology; (ii) 3D printing, additive digital prototyping on textile; (iii) Micro-controllers, sensors, and actuators to monitor the body and the environment; (iv) smart wearables: integration of electronics in garments and accessories.

The AMSF module is scheduled into 8 lectures of 4 hours each, developing in 4 weeks and divided into two main blocks: a preliminary individual instrumental theoretical part, and a teamwork design practice-based part Fig. 1. In the first block, each lecture covers specific topics delivering theory that is followed by applicative exercises that students should conduct in class individually to directly operationalize the knowledge received within the same lecture. The theoretical lectures are delivered through instrumental explanations of fundamentals, tools, and methods of the different technologies, and presenting opportunities through best practice examples. In the second block, students work in groups to develop problem-solving and collaborative design skills, making and testing techniques and technologies to deliver an early-stage fashion-tech prototype.

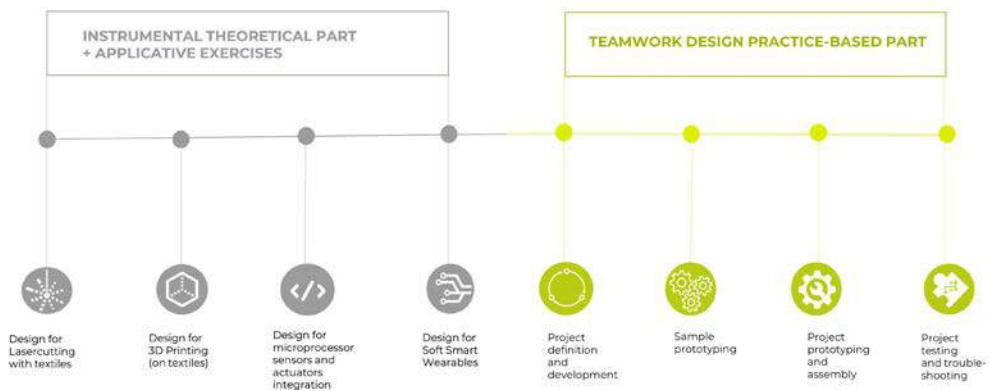


Fig. 1
AMSF module structure
and lectures schedule.

The AY 2020-21 module has been delivered in-remote modality due to Covid-19 issues and students had an extension of two months to be able to finalize the prototypes due to the impossibility of using the University laboratories. Due to social distancing, the active collaboration among the participants was very limited. The AY 2021-22 module was delivered completely in presence, thus enabling an easy and iterative collaboration in the classroom and University Laboratories during prototyping activities between students and teaching staff.

Both modules were supported by a series of tools delivered to students to understand the limitations and opportunities of the DFT and SWET. These tools are conceived both as learning materials (e.g., presentation materials, video lectures, bibliographic references, Instructables, links etc.), and exercise materials (e.g., digital files and physical samples).

For the laser cutting technologies, students were provided with video lectures about the specific laser cutter available at the Politecnico di Milano — School of Design, along with fabric swatches that showcased laser-cutting, and engraving processing on different synthetic (e.g., synthetic leather, felt, neoprene) and natural (e.g., linen, cotton, jeans) materials to showcase limits (e.g., minimum thickness resulting in product's fragility, burning edges, natural material fraying, and timing of execution depending on the complexity of the cut/engrave) but also opportunities (e.g., details precision, subtle use of engraving for aesthetical composition, etc.) Fig. 2.

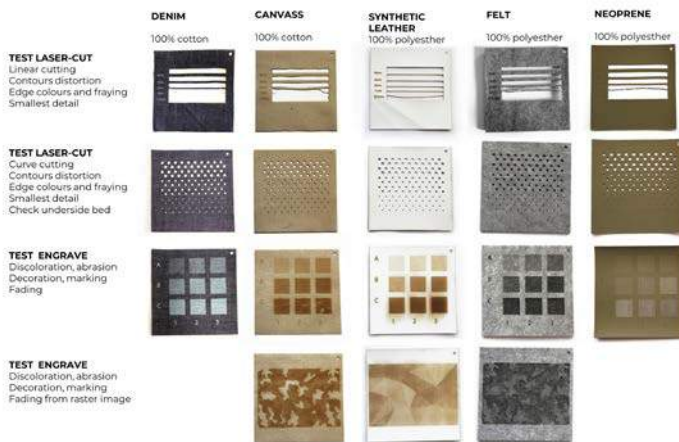


Fig. 2
Toolkit of textile swatches for testing laser cutting and engraving opportunities and limitations.

For the 3D printing technologies, students were provided with links to video lectures about the specific 3D printers available at Politecnico di Milano — School of Design Laboratories along with fabric swatches that showcased 3D printing on textile substrates such as net flexible synthetic materials to understand printing issues (e.g., the elasticity of the material for 3D shaping, the necessity of perforated fabrics for 3d printed material adhesion, minimum detail available, necessary processing activities to include the fabrics on the print bed with proper adhesion and fixation).

For the Arduino coding lectures, a series of examples and precompiled codes have been provided to be tested and simulated using Tinkercad software, to conduct this activity online and also in-presence with students. In addition to this, we provided also Arduino boards (e.g., Arduino Uno and Lilypad boards) along with all the necessary connecting components (e.g., breadboards, jumpers, crocodiles' cables), sensors (e.g., push-buttons, LDR sensors, etc.) and actuators (e.g., LEDs, coin vibro-motors). A specific lecture about

soft and textile-based sensors has been provided equipping the students with a series of conductive/resistive materials (e.g., textiles, plastic sheets, conductive threads) to guide the development of their own soft sensors.

For the sustainability part, a very small presentation has been prepared for students to recall the main four pillars of sustainability, followed by a four-pillar radar tool to be filled by students throughout the design-based part. The tool enables a discussion toward considering the sustainability impacts during the students' design choices.

Outcomes of the Learning Experiences: Early-Stage Fashion-Tech Prototypes

The final results of the two modules were 7+5 early-stage fashion-tech prototypes, clustered into 5 macro topics: (i) reconnecting people on distance via tangible and digital feedback, (ii) healing anxieties and releasing the stress through self-activation, (iii) enhancing positive behaviours for acoustic and health protection, (iv) revealing social distancing via proximity sensors, (v) augmenting safety and security perception Fig. 3.

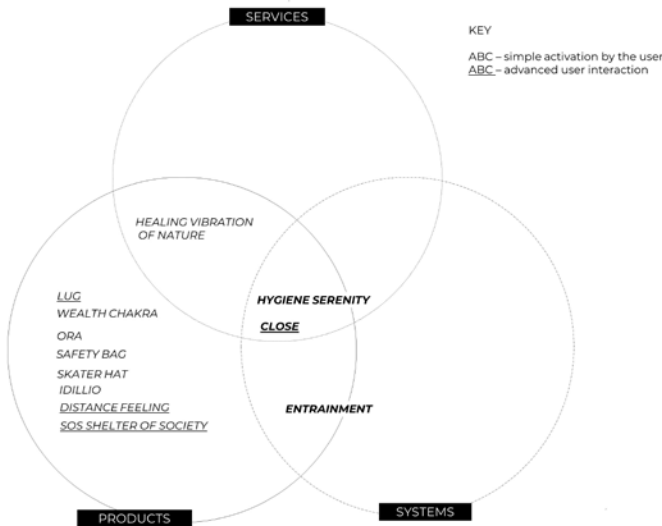


Fig. 3
Early-stage fashion-tech prototypes: clusterization between products, services, and systems, user simple activation, and user advanced interaction.

The final prototypes presented a higher focus on digital fabrication technologies through the operationalization of fundamental learning that allowed the generation of outputs on a product level. Despite this, just a few examples (*Close* Fig. 4, *Entrainment* Fig. 5, and *Hygiene Serenity* Fig. 6) achieved a real and advanced integration of those technologies with both higher functional/performative and aesthetic/emotional results. A limited focus emerged in relation to servitization of projects (25%) enabling the offer to the user of extra services apart from the product (*Close*, *Healing vibration of nature*, and *Hygiene serenity*). These prototypes actuated an extra experience on the online platforms, engaging the users in positive behaviours, customizing massaging programs, and recording relaxing habits.

The user interaction with the prototypes was very low: most of the projects (83%) focused on user activation with simple gestures, and very basic programming both for functional and emotional performances. This was due to lower expertise in programming and coding activities, limiting students' capacity to think and prototype more complex user experiences. In addition to this, few groups explored the interactions with the final users to test and validate their concepts, thus revealing a lacking habit in iterative and interactive design processes to achieve a final validated proposal. Finally, a limited focus on the system/process level of the fashion-tech solutions emerged due to unmanageable correlated complexities in the given time.

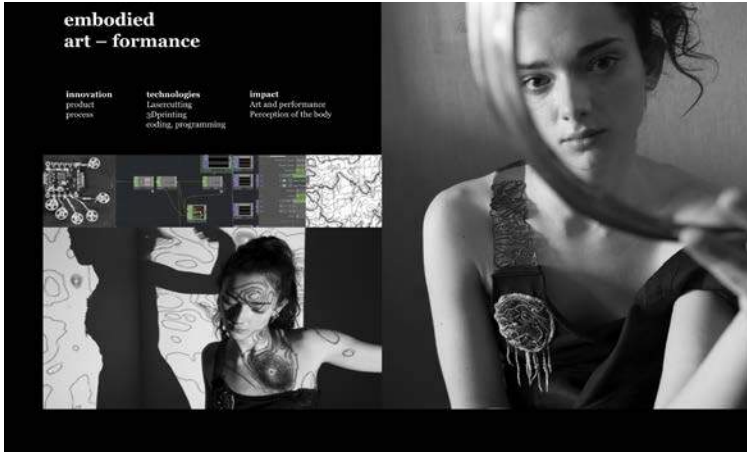


Fig. 4
Close, 2019. Ph. De Witt, B., Baroni, A., Mazza, P., Voltolini, M., & Busignani, V.



Fig. 5
Entrainment, 2020. Ph. Vroom, A. B., Carvalho, N. M., Dufour, A. J. F., Egger, N., & Castiglione, I.

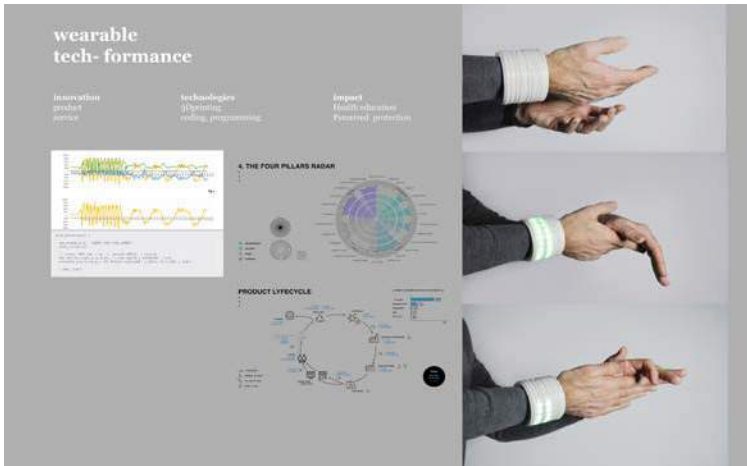


Fig. 6
Hygiene serenity, 2019.
 Ph. Gonzalez, P., Saltanat,
 K., Regaglia, A., Xue, J.,
 Ventura, G. E.

Outcomes of the Learning Experience: Fashion-Tech Skills

The results of the initial survey were compared against the reported reflections of students in their logbooks and the level of maturity achieved in the final projects. Before the start of the lectures, students reported having already expertise in laser-cutting (80%) mainly on hard materials but also on soft, textile-based materials, 3d printing (50%) not specifically for the fashion sector, but a lower level of acquaintance with microcontrollers, sensors, and actuators and coding activities (10%). At the end of the course, through the analysis of the contents of the logbook, students have:

- acquired the DFT and SWET vocabulary,
- developed digital fabrication-related skills with a learning-by-doing approach, hybridizing their design methodologies and practices from other disciplines,
- understood the logic of the complex relationships among different and complementary technologies through iterative design processes of soft wearables prototyping at the early stage of the design process,
- developed soft skills through active collaborative activities and peer-to-peer learning on complex projects,
- developed critical and self-reflective skills through the documentation of the process that is released in the logbook,
- developed an open culture based on sharing resources among peers and through active participation in collaborative design activities.

The reported feedback in the logbooks was clustered in terms of perceived benefit of the module: (i) successful learning-by-doing through fabric samples and simulators useful to evaluate the process, calibrate the design activity in a more conscious way and obtain better results with less trial and error phases (ii) appreciated one to one personalized mentoring activities through hands-on laboratory moments of practical demonstration and direct guidance on the prototype through timely feedback from experts allowing a form of collaborative learning both for student and teaching staff;

(iii) high interest in the topics of the lectures, specifically for the possibility to operationalize them in prototypes. On the other side, a series of criticalities emerged: (i) difficulty in practicing new theories and tools from other disciplines in a short timeframe; (ii) limited capabilities in translating theory into creative and innovative design solutions integrating all of them in one project; and (iii) missing critical discussions among peers and the teaching staff due to time constraints.

Conclusions and Future Improvements

The collaborative and experiential learning activities implemented in the AMSF modules were focused on discovering and solving problems through prototyping experiences with the ambition to give students more profound subject-specific knowledge, along with developing soft skills. Literature shows that these strategies are relevant in the context of teaching DFT and SWET (Park et al., 2021). Reflecting on the educational path, we acknowledge that several implementations at the level of organization and structure of the course could increase interdisciplinarity and boost both soft and subject-specific skills. An example of enhanced collaboration with different disciplines could be establishing a collaborative module with students from an engineering or design/engineering course to increase the innovation potential of the delivered projects.

Further improvements could focus on intensifying the flipped-classroom activities for more collaborative critical discussion, critical reflections, and peer-to-peer learning, also inviting experts with specific professional backgrounds to provide different perspectives about fashion + DFT + SWET intersections. Finally networking with Fablabs could be essential to extend the technological capacities from the inside the University to the external system of laboratories.

In terms of learning contents and tools, lecture materials could be increased by providing curated and systematized pieces of knowledge especially dedicated to systemic design and process innovation. These OERs and MOOCs could be delivered beforehand the module to have an entry point of knowledge and a leveled preparation before the practice-based part of the module.

In addition, the elaboration and provision of more swatches samples for 3D printing on textiles exploring functional (e.g., printed buttons and accessories), performative (e.g., elastic deformation and flexibility), and aesthetical (e.g., micro-decoration, multiple-colours, etc) and laser cutting on textile exploring modularity, laser cutting and zero-waste approach and auxetic structures could enable the students with more proper insights on the positive use of digital technologies toward societal and sustainable challenges.

Finally, the course should enhance the part dedicated to microprocessors, electronics with hard and soft actuators and sensors, and coding applicative exercises. In this regard, the structure of the course could be inverted by dedicating two initial lectures on this topic, providing the students with more samples of hard sensors and actuators (e.g., humidity, heat bit sensors, accelerometer and gyroscopes, microphones, buzzers, speaker, etc.) but also soft ones.

All these implementations could improve the quality of the learning outcomes and the critical reflection of students on the topic, approaching not just as technological integrators but investigating functionality, aesthetics, cultural and social acceptance, and sustainability as major drivers of the design directions toward a systemic paradigmatic change of the fashion industry.

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Co-designing Contents With Situated Stakeholders: An In-Field Process in Nolo (Milan)

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Abstract

Neighborhoods today emerges as “design incubators” as they are characterized by the proactivity of local actors — such as citizens, shopkeepers, associations, informal groups — acting at the core of the design process by developing brand-new and tailor-made solutions and at the same time provide environmental, economic, and social beneficial transformation in an inclusive and democratic way. This work presents considerations from a two-years initiative named Off Campus Nolo (OCN), a living lab promoted by the Politecnico di Milano that opened its doors in the Nolo neighborhood (Milan). With its rich set of contents (activities, projects, and events) the experience of OCN demonstrates how creating a bridge to transfer the academic skills on a neighborhood-community level can improve the quality of actions to be developed, also exploring new ways of spreading the knowledge from the academia and prompting new forms of social innovation within neighborhood communities.

Keywords

Neighbourhood communities
Public spaces
Proximity
Participatory design
Social Innovation

Introduction

The challenges of social cohesion in cities can now be tackled starting from on-site activities with local communities, using processes and practices specifically designed for the contexts. Indeed, local communities acting mainly at the neighborhood level have great potential — and a moral responsibility (Deshpande, 2016) — in creating both physical and digital places that facilitate civic engagement and community interaction. Neighborhoods today emerge as “design incubators” powered by the proactivity of local actors — such as citizens, shopkeepers, neighborhood associations, and informal groups — acting as “active collaborators” (Thorpe & Rhodes, 2018) at the core of the design process by constantly caring for urban commons. Those commons such as streets, squares, parks, interstitial and residual public areas, are common resources daily lived by citizens, “neighborhood amenities” (Foster, 2011, p. 57) temporarily shared and used by the local community for the most diverse activities (Gehl, 2013; Groth & Corijn, 2005). Gehl presents his latest work creating (or recreating). The involvement of citizens in the management of urban commons — and in planning processes in general — is increasingly considered by local administrations, thanks also to new types of administrative tools that enhance the role of citizens in developing and co-designing brand-new solutions and at the same time provide environmental, economic, and social beneficial transformation. This work presents considerations from an ongoing initiative named Off Campus Nolo (OCN), a neighborhood living lab that opened its doors two-years ago in the Municipal Market of Nolo (Milan). “OFF CAMPUS. Il cantiere per le periferie”, promoted by Polisocial — the social responsibility programme of the Politecnico di Milano — is an initiative to make the university more responsible, attentive to social challenges, open and close to marginalized territories and communities, through the activation and facilitation of projects and inclusive processes with existing local entities. The living lab has played an important role in making the neighborhood more inclusive, safe, resilient, and sustainable by actively engaging with local communities and working together to co-design solutions for urgent issues identified over the years by the citizens.

Working With Local Communities: The Launch of off Campus Nolo

Polimi DESIS Lab, the research and design laboratory for social innovation at the Department of Design (Politecnico di Milano) to which the authors belong, has been dedicated to didactic and research activities since 2016 in Nolo (Nord of Loreto), a vibrant neighborhood located in the outskirts of Milan’s historical city center. Nolo for years has been at the center of a process of “beautification” (Fassi & Vergani, 2022) promoted by the active “NoLo Social District”, a Facebook group connecting online more than 12,000 members that have imagined over the years a series of social cohesion interventions and events — such as traveling shows, neighborhood breakfasts, historical walks in the streets — aimed at the well-being of the citizens (ibidem). Since September 2020 — the opening day of

OCN — the community of the Politecnico di Milano started to foster the already proactive neighborhood by promoting new courses of transformative actions using a set of tailor-made tools and methods. The urban living lab has been designed to be a space open to the community, hosting an observatory on issues related to the regeneration and reactivation of neighborhoods, educational laboratories and workshops, seminars and open lectures, exhibitions and public events and an archive of projects developed over the years. Since its opening, OCN and its academic actors developed research projects, community-making practices and volunteering activities, giving voice to the local community, collecting stories and experiences (going beyond language barriers, age, and social backgrounds) to envision and design brand-new solutions for the neighborhood.

Delivering Research and Teaching in the Field: New Roles for Scholars

Merging the first two missions of universities (*education* and *research*) is becoming a way to observe specific contexts dealing with complex issues on a neighborhood scale. Creating a bridge to transfer the academic skills on a neighborhood-community level can improve the quality of actions to be developed, also exploring new ways of spreading the knowledge from the academic real and prompting new forms of social innovation with neighborhood communities (Fassi & Vergani, 2020). These goals can be reached by focusing more on the *third mission* of universities, promoting entrepreneurial skills, innovation, social welfare, the formation of human capital (Compagnucci & Spigarelli, 2020) and producing social values by fostering well-being and civic awareness using methods of effective cultural, social and educational impact (Fassi & Vergani, 2020). This process — that stands between bottom-up and top-down approaches — must be led by the academic realm and its actors, delivering research and teaching activities in the field assuming a brand-new role. As for OCN, the living lab is managed by the *offcampusers* (OCs), i.e., the university community of professors, researchers, PhD candidates and interns who also have the role of activators, facilitators, and volunteers to help the community of Nolo and its shortcomings (Fassi & Vergani, 2022). Before embarking on a new journey with the opening of OCN, the Polimi DESIS Lab community organized four semester-based design studios Fig. 1 allowing post-graduate students from the MSc in Interior and Spatial Design (School of Design, Politecnico di Milano) to design spatial and service solutions in a real context characterized by a “creative community” (Meroni, 2007) still under construction.



Interacting on a Situated Level: Connecting Stakeholders

Neighborhoods are complex *patches* of the wider urban scale. They are social and political spaces generated by cross-species transformative encounters developed through contamination, which constitute temporary *assemblages* unevenly distributed throughout time (history) and space (lively landscapes) (Keleman Saxena, 2021). In this sense, we can think of neighborhoods as *assemblages* of different *agents*¹ and cultures, open-ended interactions between life-forms living together in a community (Tsing, 2015; Tsing et al., 2017). Borrowing the term from the concept of *situated knowledge*² by Donna Haraway (1988), in the process the authors refer to this fluid set of individuals (Bauman, 2013) as *situated stakeholders* (Fassi & Vergani, 2022) Fig. 2, embracing the widest typologies of *agents* present in this particular context and acknowledging the pluralities and divergences played out throughout time (De Rosa et al., 2021). Nolo, like most other places, is a sum of *overlapping geographies*, different portions of spatial, social, cultural identities of a context that are mainly the results of a series of cultural and historical changes given by the development of the city over the centuries (Fassi et al., 2021). This *geographies* are linked to the neighborhood different layers that must be traced and bring to light in order to create a *situated* common discourse built on “common interests” (Haraway, 1988). Working together to map the context and its features, envision concepts and design solutions means including the *situated stakeholders* in all the phases of the process, opening a transformative discourse touching all the different levels and scales of the community, from single citizens up to public bodies. This process must embrace all the public spaces of the neighborhood, interacting with the community using a participative approach and fostering agonism (Arendt, 1958; Mouffe, 2007) to avoid polarization and imagine several innovative solutions.

Fig. 1
The four semester-based design studios organized by the Polimi DESIS lab. © Francesco Vergani.

1
Agents. From the Latin word *agens* — one who acts by causing a certain effect. In *Treccani.it dictionary*. <https://www.treccani.it/vocabolario/agente/>

2
Situated knowledge is the knowledge that is embedded in, and thus affected by, the specific historical, cultural, linguistic, and value context of the knowing person. In *APA dictionary of psychology*. <https://dictionary.apa.org/situated-knowledge>

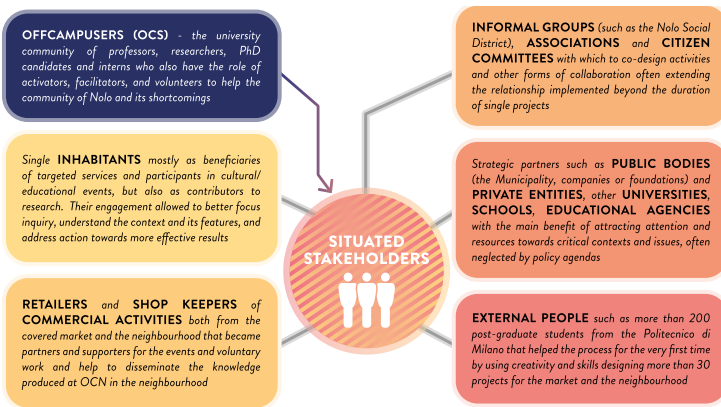


Fig. 2
The *situated stakeholders* of Nolo. © Francesco Vergani.

Objectives

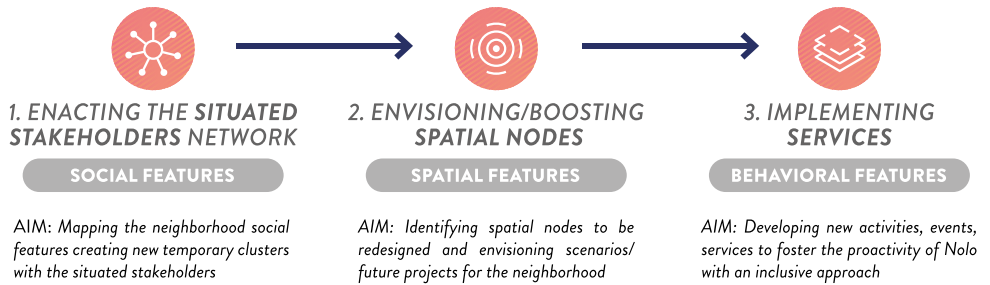
OCN plays an important role in prompting new forms of social innovation by laying the foundations for a more inclusive and ecosystemic bottom-up approach, aimed at making the neighbourhood more proactive, sustainable, innovative, and resilient. Projects and services designed by the *OCs* are always co-designed with the *situated stakeholders* to better fit the needs and expectations of the people involved. In this sense, the living lab is not restricted to the work implemented at OCN and the Municipal Market where it is placed but permeate the whole neighborhood thanks to its actors who aggregate in always different clusters around specific issues. OCN combines social engagement and academic skills to:

- Valorize the Municipal Market and the neighborhood.
- Envision and develop new transformative actions with tailor-made projects and processes for the community, pursuing sustainable life at a neighborhood level by using the approach of *proximity*, intended as a system of close functions and relations (Manzini, 2022).
- Foster the proactivity of Nolo with an inclusive approach promoting a more horizontal approach and openness to direct participation of the *situated stakeholders* in both intercepting values, needs and expectations of Nolo. At the same time OCN aims at giving voice to more fragile communities, developing responsible attitudes, expertise and new values in future generations of citizens and helping to increase awareness to face the challenges of a constantly changing world.

Methodology

Since September 2020, OCN has strengthened its mission by expanding its network with new alliances, developing strategies to re-design spaces, and fostering a practice based on *care* to imagine new projects and services for and with the neighborhood. In this sense, OCN plays the role of a “platform” (Huybrechts et al., 2021; Tassinari & Vergani, 2023) to map the multiple perspective from the local community of Nolo, promoting and implementing different

levels of intervention (social, spatial and behavioral). Most of the projects activated by the OCs use research through design processes (Herriott, 2019; Koskinen et al., 2011; Stappers & Giaccardi, 2017) to reflect on contemporary issues, envision transformative actions and co-design new solutions. Those projects are indeed “potential generators of knowledge” (Stappers & Giaccardi, 2017) since they aim at developing new forms of knowledge that are shared between the academic realm and the society. The works conducted so far at OCN can be clustered in a design process condensed in three main steps Fig. 3.



A
Enacting the situated stakeholders network (Social features)

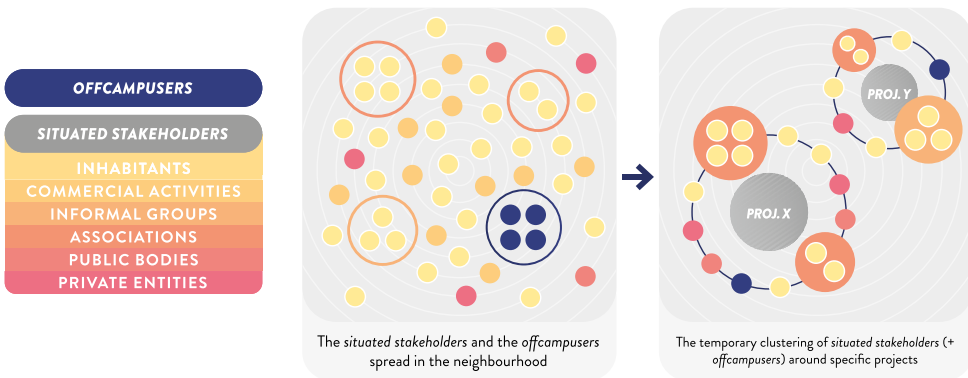
Fig. 3
The design process enacted at OCN. © Francesco Vergani.

To map the *situated stakeholders* network, the OCs promoted a participatory design process using quantitative and qualitative tools exploring the context through direct observation (Koskinen et al., 2011), collecting data, co-designing contents and finally validating the concepts designed. This process is crystallized in the “Vocabolario di Quartiere” (VdQ) research project, a neighbourhood vocabulary that acted as a prompt to dis-articulate and re-articulate points of view and meanings and trigger a cultural discourse on the neighborhood developed by the same neighborhood using a participatory design approach (Vergani et al., 2022). Specific attention is paid to the Vocabulary’s potential to include different “voices” — ideas, stories, points of view — bringing them in dialogue to envision common matters of concern and new courses of transformative actions. This collection of “voices” took place during co-design activities, workshops and interviews triggered both in the physical space of OCN and on online platforms and social media. “VdQ” paid specific attention to include those points of views that are normally unheard, such as those belonging to fragile communities that tend to be excluded or marginalized (foreigners, elderly, children, people with physical disabilities) (Tassinari & Vergani, 2023; Vergani et al., 2022). In this sense the OCs are trying to expand the very meaning of “stakeholder” by embracing also more-than-human agents as individual citizens that must be included in a cultural and innovative transformative discourse. In this process, OCN relies on the voice of scientists (botanists, zoologists, microbiologists, but also environmental activists and practitioners) that act as “representatives” (Latour, 2018) for the more-than-human realm injecting peculiar points of view. Putting

these different “voices” into dialogue is an innovative way to create a shared neighborhood culture, not only to counter social polarizations, but also to imagine possible future actions that take common interests into consideration (Vergani et al., 2022).

B
Envisioning/boosting spatial nodes (Spatial features)

Networks of stakeholders are always connected to both physical and digital places. Neighborhoods can be considered as *stages* where communities of people (and more-than-human agents) daily perform both individual and collective actions according to their needs and visions. In this sense, the *situated stakeholders* are individual agents that aggregate around specific *spatial nodes* — intended as “micro-spaces of daily life” (Sassen, 2004) — where local actors meet and interact. These temporary clustering of the Nolo “project-based community” (Fassi & Manzini, 2021) — specifically combined according to the peculiar skills of each stakeholder — are built after the mapping process when — thanks to the help of the citizens — the OCNs identified specific *spatial nodes* linked to widespread issues felt by the community Fig. 4. In this sense, the temporary cluster “adopts” the *spatial node* for the timespan of the project by redesigning, taking care and developing initiatives to make it safer, more inclusive, and resilient.



C
Implementing services (Behavioral features)

OCN acts in the neighborhood with a sense of *care* for its people and spaces, trying always to develop tailor-made solutions to support the needs, expectations, and visions of the Nolo community. In this sense, the work conducted on the previous two different features (social and spatial) always aims at prompting actions and behaviors in the neighborhood, giving the *situated stakeholders* new services and initiatives on educational, cultural, volunteering and recreational levels.

Fig. 4
Diagram of the temporary clusters of *situated stakeholders* around specific projects. © Francesco Vergani.

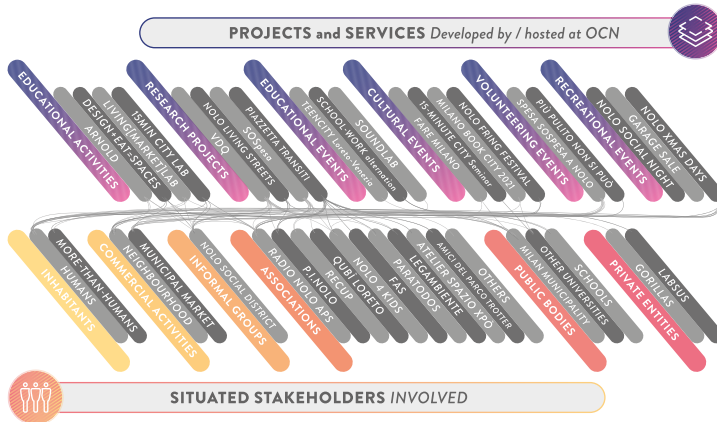
Results



Fig. 5
Cards depicting all the contents (research projects, activities, events, etc.) created at OCN. © Francesco Vergani.

In the first two years, the OCs and the *situated stakeholders* have developed new contents Fig. 5 specifically designed for Nolo and its community. Regarding the work done on a neighborhood scale, OCN fostered those approaches to improve the quality of urban contexts through low-cost and short-term intervention such as *Placemaking*³ and *Tactical Urbanism*⁴ (Lydon & Garcia, 2015; Markusen & Gadwa, 2010; Thomas, 2016; Webb, 2018). Thanks to the project “Nolo Living Streets”, OCN designed parklets for more than twenty commercial activities, transforming 180.5 square meters of public space into recreational areas. As for the Municipal Market (built in the 1930s of the 20th Century), OCN injected new life to the covered market making it more attractive for its unusual mission by a series of micro-intervention to both renew some of the aesthetic features of the structure and put in place new actions and events to revitalize its social life Fig. 6.

3
Placemaking refers to a collaborative process by which communities of people can reimagine and reinvent the public realm to maximize shared value. In *What is Placemaking?*. Project for Public Space. <https://www.pps.org/article/what-is-placemaking>



4
Tactical urbanism is an approach to urban planning that includes low-cost, temporary changes to the built environment, usually in cities, intended to improve local neighbourhoods and city gathering places (Pfeifer, 2013).

Fig. 6
Projects and services developed by/hosted at OCN. © Francesco Vergani.

After mapping strengths and weaknesses of different *spatial nodes*, the OCs collected ideas on more than 10 spaces developing redesign strategies based on available social and economic resources. OCN — together with the *situated stakeholders* — applied those administrative tools (such as the “Participatory budgeting” or “Collaboration Pact”) that enhance the role of citizens in developing and co-designing new spatial — and therefore also social and behavioral — solutions. Spaces like Piazzetta Transiti (an area of 1,031 square

meters to be redesigned together with 13 entities), or an unused courtyard close to the market, are currently under planning/development by temporary clusters of *situated stakeholders* (Tassinari & Vergani, 2023). OCN strengthened the proactive network of Nolo introducing in its activities those silent and “marginalized” communities that are usually excluded from these types of participatory design processes. In this sense, the approach implemented by the “VdQ” project aimed at engendering a new, inclusive and resilient neighborhood culture, generating a process of empowerment/community infrastructuring (Björgvinsson et al., 2010; Ehn et al., 2014), and fostering the “radical interdependence” (Escobar, 2018) by caring for the human/more-than-human entanglements. Activities such as “Gaia’s Club” — an interactive and transmedia storytelling workshop involving children from the neighborhood in an awareness-raising co-design session to highlight the current social and environmental emergencies – aimed at bonding social with environmental justice to uncover the common interests of Nolo and work for a just, equal, democratic and inclusive neighborhood (Tassinari & Vergani, 2023).

Conclusions

OCN is a multi-purpose format that proved to be particularly suitable for binding research, teaching, and action together, providing some methodological principles that could be possibly scaled and replicated in other contexts. Each context is different and hides latent possibilities that must be brought to light by someone who can navigate within the diversity of the *situated stakeholders*, leading the way towards a common goal. The peculiar feature of the model is giving by the tailor-made and three-steps process (1. Enacting the *situated stakeholders* network, 2. Envisioning/boosting *spatial nodes*, 3. Implementing services) that implies a continuous dialogue between the academic realm and the context of application. As for the academic realm, the model offered by OC with the hybrid figures of the *offcampusers* is useful to develop different skills that go beyond those given in the academia, learning and creating new knowledge directly in the field while managing social innovation projects with a high degree of complexity. The group entered in the context years before the implementation of OCN, getting in touch with local dynamics, testing and co-designing small spatial and service interventions with academic projects. This first part of field research was essential for the birth of OCN as it is essential to fit in an unknown context with a light and respectful approach to neighborhood dynamics, avoiding top-down intervention that too often struggle to grasp the real needs and visions of the communities. In this sense, OCN can be considered as a best-practice of community-making processes that stands between bottom-up and top-down approaches and a prime instance of how universities can invest in the third mission sending scholars into the real contexts of application.

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Creativity and Mirror Effect: Teaching Creative Skills Through Non-traditional Pedagogies

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Abstract

Design pedagogy is crucial for transferring project methodologies and fostering creative skills. However, the technological and social transformations of this century have challenged traditional educational canons and the very definition of creativity. This article proposes that this challenge can be analyzed through non-traditional educational paradigms to address this challenge from a design methodology perspective.

It first reviews the existing literature on creativity training and presents a case study on training methodologies. This case was incorporated into an undergraduate design course, providing insight into design pedagogy itself. Then, the article discusses the future challenges and projections of Design education and the cultivation of creative skills for the 21st century. Finally, by examining alternative educational approaches, this research contributes to the current discourse on design pedagogy and its adaptation to the changing needs of contemporary society.

Keywords

**Design
Creativity
Non-traditional education
Project-based learning
Environment**

Introduction

Education for creativity has gained prominence since its prioritization among the most relevant skills for the 21st century. The interest in this new set of abilities is to allow people to adapt to a changing and uncertain world. Among others, we also find innovation, critical thinking, observation, prototyping and iteration. All of them are linked to divergent thinking and process-focused methodologies. They allow you to rehearse several answers to a problem, ask questions and try different paths. Traditionally, the formation of these skills has been driven by non-traditional education methodologies and programs. But, from the point of view of design pedagogy, these are very familiar methodologies and skills in the teaching and performance of the discipline.

It can be argued that design degrees are inherently creative. But in the face of new challenges in work, business and social world, students must update their skills and competencies based on these tools. In this sense, we can ask ourselves: What definition of creativity do we refer to? How do we encourage creativity in the training of Design students? Can some non-traditional education methodologies contribute to the above questions?

Creativity, a Dynamic Concept

Within non-traditional education, Maria Montessori was a pioneer in integrating the concept of creativity and highlighting the importance of play in the development of intelligence. After supervising nursing homes for children with “mental weakness” — as they used to be called — she observed how they played with breadcrumbs and in that process the skills for learning were generated. This experience defined the foundational elements of her pedagogy: the *observation* of the child in their environment as a method of knowledge and the *game* as a means and object of study. Montessori states that “all children learn through play/work: because play is children’s work”. Being “educated for life”, allows children to develop freely, contacting their subjectivity and helps them develop intuition, imagination, initiative and perception as well as the creation of innovative solutions to problems. Montessori discovers that play is spontaneous and always starts in response to one’s own development needs. The premise that children are agents of their training and that to learn they need freedom and multiplicity of options from which to choose, gives the teacher the responsibility of creating a prepared environment, which stimulates the child so that they can deploy and conquer their autonomy.



Fig. 1
Municipal School 1930-34. In this image we can find: movement and relationship with the environment, peer and outdoor learning, encouragement to autonomy and sensory development through haptic and audition. Source: Fotográfico, Barcelona.

In Chile, the biologist Humberto Maturana adds another variable: he takes learning out of the purely rational dimension and says that for it to exist there must be first and foremost emotion, “emotion is the foundation of the rational” and this is closely related to creativity. “Creativity is a spontaneous phenomenon of living beings, because every living being begins to invent its world from the moment it’s born”. As monitors we must open reflective spaces because each situation is the reason for a question. “Creativity is not taught, it is liberated” so creative thinking is a universal and democratic phenomenon, and each individual has the potential to think creatively.

Finally, Joy Paul Guilford, a pioneer of creative thinking and one of the founders of the Psychology of Creativity, relates the term to intelligence: “the multiple similarities between the phenomena known as *problem solving* and *creative production* make possible and desirable that both are considered the same topic”, that is, intelligence and creativity allow the child to know their reality and can subsequently transform it.

In his theory he highlights four factors:

- *Fluidity*: number of solutions provided to a given problem,
- *Flexibility*: variety of ideas produced,
- *Originality*: relative rarity of a produced idea,
- *Feasibility*: ability to produce ideas and solutions achievable in practice.

While non-traditional education has focused on childhood, it has a point of view in which not only the student and the teacher but also the environment, make up a system for the student to design the conditions to be able to express and manifest themselves. These elements are possible to address and transfer to the Design degree, as it also deals with the challenge of generating creative environments.

Learn to Unlearn

As Larry Vint (2005) mentions, the premise that creativity is a universal phenomenon and that we all have the potential to be creative and innovative has been endorsed through research and has been tested, documented, and published many times (Land & Jarman, 1993; Higgins, 1996; Naiman, 2000). What does seem to be a common denominator of literature is that as children we have greater creative capacity, since we do not have social impositions and boundaries. A particularly loquacious investigation of this phenomenon was carried out by George Land and Beth Jarman in 1968 and published in 1992. In it, Land and his team tested 1,600 five-year-olds with a creativity test that was the same used by NASA to select innovative engineers and scientists, the results were impressive: 98% of the children scored in the “highly creative” range.

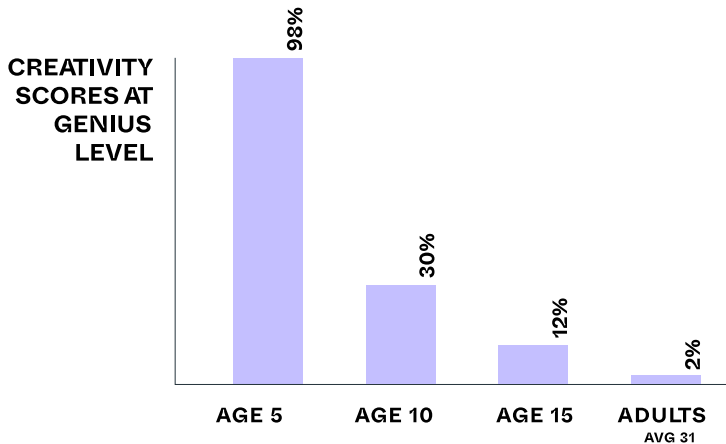


Fig. 2
George Land and Beth Jarman, *Breakpoint and Beyond*, 1993. Dr. George Land and Beth Jarman developed a test to measure creativity by assessing the ability to divergent thinking: this is the ability to face a problem, challenge or object and find multiple solutions or different ways to use the object. The more possibilities the subject can imagine, open or explore, the more creative he is. Divergent thinking is what scientists consider most creative Adapted from: Land & Jarman, (1993).

As we can see in the graph above, the research shows us that creativity declines as years go by, but what is particularly interesting in this study is that Land did not test groups in parallel but retested the same children *through* the years. Five years later, in 1973, only 30% of these 10-year-olds were still rated “highly creative”. By the age of 15, just 12% of them were ranked in this category; in 1985 Land tested 280,000 adults to see how creative they were, only a 2% of adults over at the age of 25 who had taken the same tests were still on this level. “What we have concluded”, wrote Land, “is that non-creative behaviour is learned”. And as Vint tells us “From this and similar research we can conclude that creativity is therefore not learned, but rather unlearned”.

The Project: Origin and Destination

Traditionally, in the teaching of careers identified as creative, the project constitutes the nucleus around which the contents are articulated. This is why implementing a project-based learning (PBL) experience in the discipline of design can be a strategy close to our pedagogical practice, however, not just any project resolution constitutes a PBL.

The PBL (PBL; Markham et al., 2003; Trujillo, 2016) is a methodology that organizes the curricular content around a project in which the students participate in its design, organization, execution and dissemination, promoting critical thinking, problem solving, collaboration and communication, that is, developing their creativity. Under this approach, it is intended that the student be an agent of their education, thus avoiding traditional structures of a passive nature. For Thomas (2000), PBL is defined around five ideas: first, the content of the project is not something that serves to enrich the curriculum, but it is the curriculum itself; second, the project must be guided by an initial question or challenge that motivates and tries to solve itself; third, students engage in a process of research, content creation, and resolution; fourth, the projects are not closed modules and allow the choice of the student; fifth, the projects must be real and not a simulation (Botella & Ramos, 2019).

As we have reviewed previously, different studies suggest that creativity is a universal skill, we can even conclude that the vast majority of adults had a high creative ingenuity during their childhood (Land, 1992).

Montessori and PBL methodologies point out that, as teachers, if we want to enrich our students' creativity, we must promote environments and projects where they can develop critical thinking, problem solving, and decision making. These projects must involve fieldwork and be real cases, as they constitute a rich source of learning and development of autonomy, more so in a post-pandemic context.

In addition to the arguments set out above, in order to encourage the creativity of the students, we propose that they should be in direct contact with the children, in an exercise in which there is a transgenerational relationship and mutual learning. This, under the hypothesis that it could help to unlock their creativity. This experience is what we will call "the mirror effect".

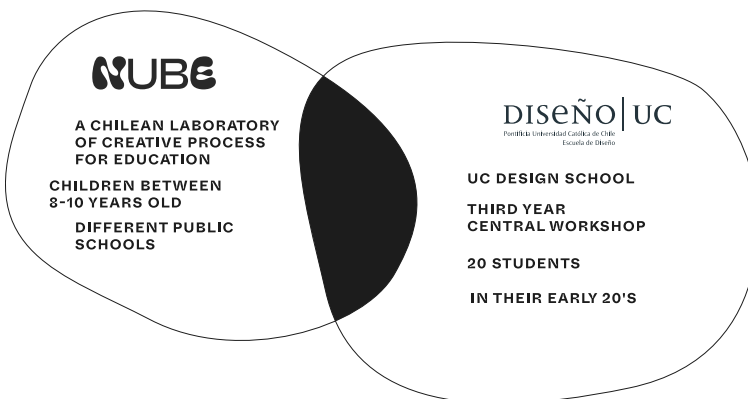


Fig. 3
Scheme of the workshop
and the mirror effect
between Design School
of Pontificia Universidad
Católica and Nube Lab, by
Author.

Numerous educational initiatives have recently emerged addressing the skills of the 21st century. *The Spotlight report: Abilities of the 21st century in Latin America and the Caribbean* de HundrED (2021) highlights 15 programs, including *Nube Lab*. This project aims to integrate contemporary art in primary education. Its method, inspired at the artist's workshop, develops and enhances essential creative skills to face the new challenges raised by contemporary societies. Based on the construction of collaborative networks of artists with educators, *Nube* has democratized access to art and culture for more than 18,000 Chilean children. Through collaborative creation strategies, artists-teachers, designers and researchers carry out activities that use accessible materials, often disposable.



Fig. 4
Nube is a Lab and also a method, inspired at the artist's workshop that develops and enhances essential creative skills to face the new challenges raised by contemporary societies. Ph. Nube Lab.

Due to the pandemic, *Nube Lab* had to reinvent itself in order to continue fulfilling its commitment. One of their projects was the creation of audiovisual capsules with nine national artists, who opened their workshops to present their creative processes and visited the Nube studio and carried out an artistic-educational activity that children could replicate in their homes.

The challenge presented to the Design workshop consisted of solving this last instance: each group of students was assigned one of the nine artists and they had to "translate" their works, adapting them to activities that complied with the Nube principles, that is, they included three contents: *de-abstraction* (1), *emphasis on the process* (2) and *plasticity* (3), and that, in turn, were divided into five dimensions: *knowledge*, *actions*, *attitude*, *sensitive exploration* and *reflection*. Design students had to be interpreters and articulators between two worlds.



Fig. 5
 In *Nube Lab* a successful activity has the basic resources for its development, especially in terms of time, space and required skills. Regarding the processes, it is considered that an adequate activity keeps all the participants involved in its realization, stimulating autonomous experimentation and fostering a collaborative and joyful work environment. Finally, in terms of results, an activity is successful to the extent that it yields learning and attractive products for its users, and whose benefits are projected beyond the workshop space. Ph. Nube Lab.

The choice of the case of study addressed in the Design workshop is not naive and intended to consolidate a prepared environment, even during confinement. By having contact with *Nube Lab*, the future designers were witnesses and participants of a space that encourages creativity through project-based learning. For this reason, it was sought first to identify with the problem through parallelism with their own learning experience, and second, to open spaces for reflection and questions, as Maturana proposes. This is what we call mirror effect pedagogy, in this case between the children and artists invited by Nube and the Design students. This is supported by neuroscience, because when we observe another carry out an action, a perception-action system is set in motion, which is precisely what allows us to imitate the behavior observed, even in relation to emotions. In this way, the mirror or empathy neuron system allows us to understand others and creates a link between the mental and the emotional.

One of *Nube Lab's* entry barriers is that often children are already oriented to production and generation of answers, towards functionalism. It's quite a challenge to break them down so they can re-integrate the game, and with it, the value in the process. There is a loss in relation to early childhood, as other authors have indicated: creativity is a very important factor in the development of the child's personality since in them the productive thought is latent, because they are not conditional to rigid social patterns, where spontaneity and wonder is restricted in linear forms of behavior (Trejo, 2005, p. 20).

Findings & Conclusions

In relation to the experience, we can draw conclusions in five areas: *prepared environment*, *transgenerational relationships*, *making*, *divergent thinking*, and *reflection*. The challenge remains is to find a way to measure the impact of the mirror effect on the creativity of design students and fine-tune the methodology with the discoveries and learn about similar experiences.

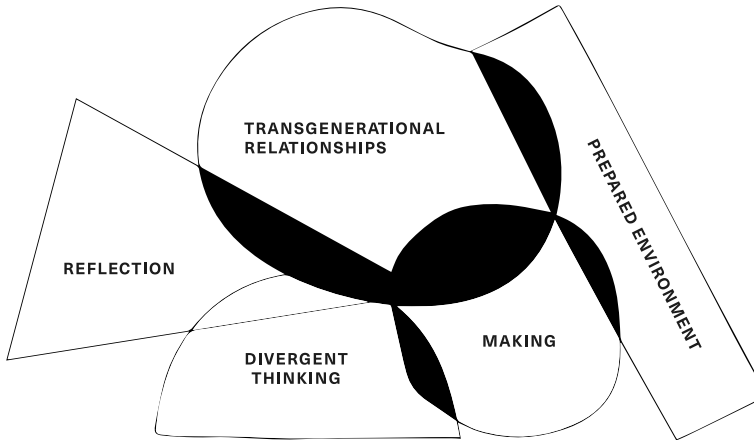


Fig. 6
Conclusions graph. We can draw conclusions in five areas: *prepared environment*, *transgenerational relationships*, *making*, *divergent thinking*, and *reflection*, by Author.

- 1 *Prepared Environment*: The entry barrier exposed by *Nube* is the same that we can find in a Design workshop. Therefore, it is important, in addition to the methodology, to build creative environments. The creative methodologies of *Nube Lab*, allow future designers to *witness and be a part of a space that encourages creativity through project-based learning*, which is a goal of design schools.
- 2 *Transgenerational Relationships*: For a generation that plans on having less children this approach teaches design students to compromise, be patient and have an overall new perspective.
- 3 *Making = Testing = Thinking*: Thoughts, choices and insights can be transformed by *physical interaction*, and interaction benefits performance.
- 4 Creativity is perhaps one of the most elusive goals in the educational system, because it seeks to foster *the divergent in a convergent environment*; the indefinite in a system that seeks to transmit the defined and known. Also, because it requires the educator to place himself in an unknown, insecure and uncertain position considering what the student is going to propose (López, 2008). However, the methodological and technical resources for the development of creativity evolve slowly.
- 5 This experience allows graduate students to identify through parallelism with *their own learning experience* and to be more open to the freedom of making, reflecting and questioning.

Creativity and innovation are the future engines of the global knowledge economy. “Industries of the mind” will play a central role in regional and national economies and ideas will be the most valuable resource on the market (Vint, 2005). As educators, we need to foster long-term learning, the skill of metacognition, by helping students prioritize what and how to learn and what topics are most relevant to engage with. Unfortunately, many of us don’t teach our students how to think creatively. To lead our students to be able to display their creativity to the fullest, we must guide them beyond the prescriptive processes and the rigid and fragmented structures of traditional education. To create an environment of divergent thinking, to inspire and generate new ideas in our classes, we must adopt an attitude of openness at each stage of the process, which allows students to achieve and maintain creativity, control and love for their learning. As Csikszentmihalyi points out, the value of the school does not depend on its ability to teach students to face life, but on the degree to which it can transmit the enjoyment of learning throughout life (Csikszentmihalyi, 2013).

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How Design Thinking Could Benefit Future Educational Environments in a Post-Pandemic Era?

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Abstract

This research paper gives an overview of students' experience in a virtual learning context during the Covid-19 pandemic lockdown. By categorising students' perceptions based on a geographic-based social context, the research analyses a general tendency of their learning experience at three different levels — family and community-based level (small-sized), region-based level (medium-sized), and international level (grand-sized). The investigation uses a hybrid research method including direct observation, interviews, and design thinking strategies — including empathising, redefining and prototyping. The author has also been referring to two directions that may enhance the future learning environment design for students' better experience. 1. To leverage the power of existing memory. 2. To research people's micro habits and the hidden psychological factor behind them.

Keywords

Virtual learning

COVID-19

Futural educational environment

Geographical level

Psychological need

Background Information

The COVID-19 pandemic enormously impacted the worldwide education system beginning in 2020. Since then, many schools and universities implemented virtual learning or blended learning as a transition to a “new normal” due to prolonged closures. According to the statistics from UNESCO, around 1.5 billion students’ normal life were impacted by the pandemic (UNESCO, 2021).

Without a traditional learning environment, people are seeking new solutions for fulfilling their educational demand. Since the beginning of the pandemic, online self-study rooms have become popular among students from all over the world, such as the platform Zoom. Studytogether, another online platform, provided an interface for those seeking study-accompaniment in a learning environment (Studytogether, 2021). To provide a better experience for its participants, the online study rooms are divided into 3 types: solo, together, and chat room. Like its name suggests, the “study solo” room is targeted toward people who are seeking a more private yet ambient place to complete tasks. On the other hand, the “study together” room is for group studying purposes, meaning it is mandatory to turn on the video function. Each Studytogether account has a personal analyse section of studying time which tracks and gives a ranking result at the end. A famous social platform among young Chinese hipsters since 2005 is called Douban. The platform provided socialising rooms for Group functions — which inspired many young people to organise meetings as shared online study rooms. Some learners are introverted and would choose to face the camera towards their desk corners instead of themselves. Even though they might feel uncomfortable by meeting strangers, they still willingly participate in group learning as they did in a traditional classroom — in a form that is more acceptable to them — for its benefits. They try to balance between their willingness to receive group pressures and their own private boundaries. This combination allows them to gain a sense of belonging, but still maintain their privacy. Like a window opening to the outside world, one can choose to close it, to half-close it, or even use a window screen to only allow the light to come in. As we can see, a new learning style has emerged under the impact of COVID-19, leading to changes in how students interact with each other. This study aims to utilize the phases of design thinking — empathize, redefine, and prototype — to understand the changing demands of users (students) and address the challenges of the post-pandemic educational environment, particularly in an Asian context.

New Trends Based on Three Geographical Level

Compared to the past, there is a remarkable change of social interaction traits among students which witnessed different patterns in virtual education. The author divides these changes into three different levels of geographic-based social context during the Covid-19 lockdown — family and community-based level (small-sized), region-based level (medium-sized), and international level (grand-sized).

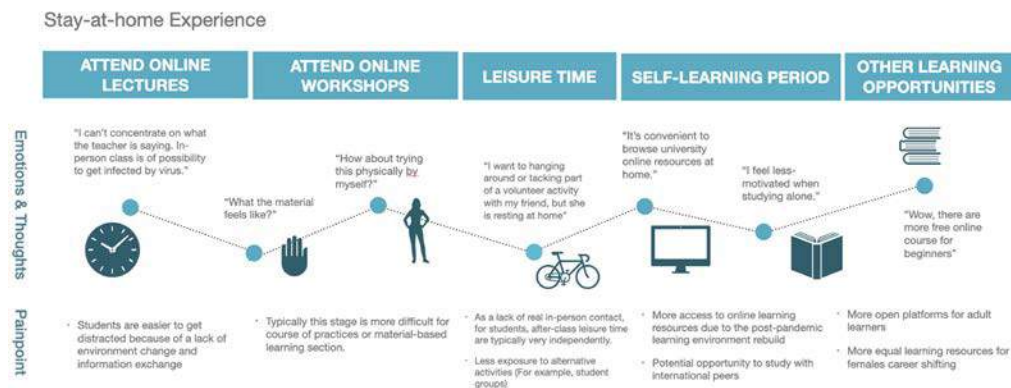
Socio-economic modernization led to a “Crisis of trust” in fast-developing societies. However, during the quarantine, mutual help increased among small-sized neighborhoods. A Swedish study in Umeå examined the impact of COVID-19 on neighborhood social support and interaction. It found that social capital can be strengthened during a crisis, particularly in neighborhoods with high pre-existing social capital (Zetterberg et al., 2021). In Shanghai, some social services were temporarily unavailable during the lockdown, prompting neighbors to form small mutual help groups on WeChat. Parents living in the same neighbourhood created group chats with shared educational goals for their children, fostering a better learning environment during quarantine.

According to Herbert Walberg’s evaluation of Harvard Project Physics, the classroom learning environment is a crucial factor for students’ learning experience (Welch & Walberg, 1972).

A study conducted in Texas examined 230 remote-learning students and observed a significant decline in student cohesiveness during the Covid-19 pandemic (Long, Sinclair, Fraser, Larson, & Harrell, 2022). The Report R178 conducted by the Institute for Fiscal Studies (IFS) found a significant decrease in students’ peer engagement in online classes (IFS, 2020).

By immersing in over 500 interactions and discussions shared on the Chinese social media platform Weibo, the author identified five major activities that students engage in while staying at home. Utilizing a user journey map Fig. 1, the author analyzed the emotions, thoughts, and pain points underlying the students’ behaviors. The data was collected from the aforementioned online social discussion. As shown in Fig. 1, the mundane learning patterns mainly result from a lack of physical peer interactions (caused by both spatial and temporal limitations) and a shortage of long-term emotional engagement among peers. One of the main issues with online lectures is that many students find it difficult to concentrate in the cozy family environment, lacking the reminder of a formal learning environment that resembles a public academic space. Additionally, a material-based problem arises, as students attending online workshops are unable to fully engage due to the absence of certain facilities or materials available in an in-person classroom.

Fig. 1
User map analysis for stay-at-home learning experiences, by Yuqing Zhu. The experiences are divided into several scenarios based on interviews conducted via WeChat app with four Chinese college students. © Yuqing Zhu.



At the family level, the pandemic presents both opportunities and challenges as it forces parents to stay at home. In the past, many families in China experienced “Widowed parenting”, where children were primarily raised by their mothers rather than both parents (Chen, 2017). Insufficient communication between children and parents leads to limited knowledge about each other’s personalities, hobbies, and thoughts and brings misunderstandings, creating a vicious circle. However, through group discussions with Chinese parents in an online alliance in Jiangsu, it was found that some well-established families are reflecting on their past parenting patterns and striving to achieve a work-life balance during the pandemic. This positive shift can foster stronger emotional bonds and improve parenting techniques for future learning.

Nevertheless, the pandemic can have detrimental effects on children growing up with depressed parents. In East and South Asian communities, strict parenting styles aimed at academic achievement are common. For instance, some children report feeling pressured to study even more during the pandemic, exacerbating the stress of the family environment. Researchers attribute this phenomenon to generational gaps and cultural differences, as sharing the same space with parents can blur personal boundaries, exposing every detail of life to one another.

Region-Based Level (Medium Sized)

Biao Xiang, a renowned anthropologist, highlighted the contemporary Chinese phenomenon of “the loss of the nearby”, where people prioritize themselves and the distant “world” but neglect the space in between (Xiang, 2021). Trust among strangers has eroded, neighbors no longer interact, and local stories are disappearing. This self-centered mindset, prevalent in China and globally, has led to a diminishing public awareness of the nearby.

Virtual networking exacerbates the situation. The classmates’ previous social networks still exist as they can still reach out to classmates and friends through video call — emotional flow is still acting. However, the network is obviously weaker than before when fortuitous socialising is decreasing. The author has been engaged in an online group chat with approximately thirty university students that have been forced to switch into virtual learning. Isolated from their peers, students reports that they are merely sharing a vague memory about their past learning experience with each other. In these memories, there were question sharing among peers when they encounter course-related problems; there were also co-working tasks with friends; after class, they enjoyed sharing interesting news and topics of books or movies with each other. These dialogues and interactions were mostly small and light-hearted events that occur fortuitously before the COVID-19 brings significant change to people’s life. Many aspects make Zoom meetings exhausting — whether it is because of a loss in non-verbal cues, a disturbance from the family background, a lack of environmental change to show meanings or hints for formal or creative dialogue or peers, a technical delay in communication, or stressful self-viewing interface. (Sander & Baumann, 2020). The author also

witnessed students' tendency to avoid interacting with unfamiliar peers due to concerns about awkwardness and the reluctance to establish new relationships for assistance.

International Level (Grand-Sized)

A more open and equal access is available for students while online educational systems are forced to upgrade to adjust to the “new normal”, which might enable ordinary people. Pei-Chen Sun has explored how online platforms foster cross-cultural communication among adult learners, enabling them to collaborate with international peers for lifelong learning (Sun et al., 2008). Among an online art learning platform, the House of Illustration, an elderly interviewee from Surrey shared her first e-learning experience with the author. She expressed her enjoyment of embarking on a unique art journey through an international online handmaking club during the pandemic. In the past, she would have needed to travel to London to participate in such events.

International communications might also be enhanced accordingly, as more international workshops or clubs are held virtually, and more people are trying to go across language barriers to understand each other in a career and interest-based friendly environment. The time people spend on foreign language learning is dramatically increasing, according to the 2021 Duolingo Language report (Blanco, 2022).

According to a EIT Digital report, digital skills are very crucial for future education especially during the COVID-19 pandemic scenario. The European Commission has set a target in 2030 agenda for digital skills (Shapers, 2022). Being forced to switch into online mode, digital skill learning has been becoming popular globally and is bringing long-term impact for the next generation.

Design Models

In the previous paragraphs, the author examined the real-life experiences of e-learning students who were compelled to stay at home. Using a user journey map Fig. 1, the author focused on specific target groups and analyzed the challenges they faced, as indicated in Fig. 1. Within the analyzed problems, the author chooses one as an example — “the lack of environment change” — for further inspection. By studying the pain point, the author redefines the new design problem as follows: How can an engaging emotional connection to the familiar formal study environment be rebuilt and how can the real-life experience in offline lectures be mimicked?

The author has been prototyping a design model, to test the potential of navigating the future education systems from both the psychological and physical perspectives. The prototype is a self-learning set that helps create an engaging environment during lockdown period. Research in cognitive science shows that memories can enhance a human's emotional engagement by tracing back to the past or a settled environment. Cognitive science research by psychologist Smith (1979) demonstrated how matching or mismatch-

ing contextual cues during encoding and retrieval impacted memory recall and recognition of word lists. Based on his findings in human learning and memory, the prototype aims to emulate the campus studying experience and helps to engage students by building a similar physical and psychological learning environment.

Fig. 2 shows a virtual reality set. When wearing the facility on, there are two interfaces that create a real-life learning experience. Users could see their learning materials on the first layers, and the second layers would project an in-person classroom environment. The learning environment is personalised according to the user's memory.

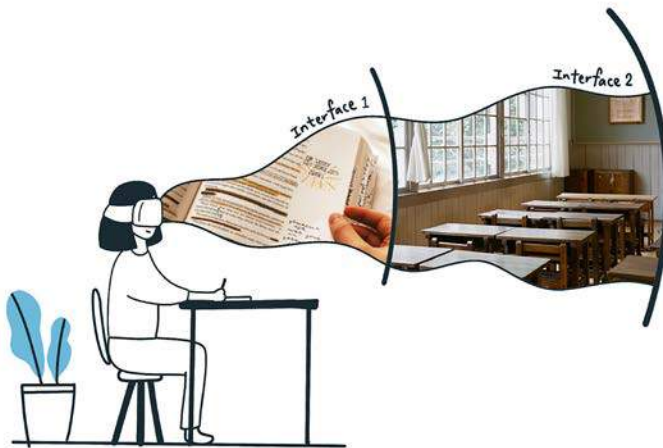


Fig. 2
Conceptualisation of
virtual learning tool, by
Yuqing Zhu. © Yuqing Zhu.

Discussion

To some extent, the pandemic has provided opportunities to enhance traditional education through complementary solutions. The redefined design problem focuses on addressing the stressful challenges caused by the unbalanced pattern in the post-pandemic era. The author has formulated novel requirements for future education, including adaptability to various scenarios, integration of blended learning patterns (combining virtual and physical attendance), and the technical replicability of modular educational platforms.

Using design thinking as a research method, the author emphasizes specific groups of e-learners' journeys and redefines the real problems they face. Scholar Sutterlin (2018) highlights that new learning modes often resemble interactive books rather than classrooms. While e-books are valuable for knowledge dissemination and resource equality, traditional settings are still emphasized for their social interaction, non-verbal communication, immediate feedback, and structured learning environment. Building on this background, the author redefines the future learning environment design problem as exploring the way of creating an experience that preserves the essence of traditional teaching.

From a cognitive perspective, emotional engagement is crucial in virtual learning. For example, abrupt interruptions during online activities can make people uncomfortable and offended.

Online group work may also bring subtle embarrassment when trying to engage with a few individuals without disturbing others. To address these challenges, the author suggests prototyping a toolkit for mutually supervised management among peers or developing an educational system with appropriate social boundaries in the interface design of remote tools. Social and interactive experiences among peers are influenced by personal boundaries, which constantly change. Considering this, the author proposes two potential directions for future development in education: leveraging the power of existing memory and researching people's micro habits and the underlying psychological factors.

The Power of Existing Memory

In the previous discussion, the significance of past memories and psychological experiences, such as peer interactions, social events, and group study activities, for students has been emphasized. Design thinking can be employed to explore the potential benefits of using technology or other methods to perceptually remind students of school scenes and their associated experiences. This prompts the question: would it be helpful to incorporate such reminders, and if so, what design solutions can be implemented?

Design prototyping offers a practical approach to address this inquiry, such as recreating a familiar classroom setting that captures the social environment. Within a small group, designers can test the feasibility of this solution, incorporating design elements to simulate the white noise of a school setting. Future designers can explore integrating interactive online social tools in virtual classrooms, including features like a shared virtual blackboard, a reading corner, and individual virtual mailboxes. Customizable spaces can reflect each class's identity and sounds like classmates chatting and sports activities can serve as reminders. As the class concludes, the lights and sounds gradually dim, allowing students to virtually step out of their rooms and enjoy after-class hours. These audio-visual cues stimulate the senses, evoking pre-existing memories and creating familiarity at home.

People's Micro Habits and the Hidden Psychological Factor Behind Them

Design thinking research aims at recognizing important and tacit details of user's demands, such as looking into people's micro habits and hidden psychological factors. When personal boundaries are intruded upon, individuals, particularly introverts, tend to reestablish them. Those with heightened sensitivity are highly attuned to environmental changes and evaluate the familiarity of unfamiliar individuals. They may wonder, "Is this person a teacher or a student?" or "Do I know this person?". Over time, individuals make gradual adjustment to feel comfortable in social situations. In online settings, leaving a small group chat without disrupting others can be challenging, causing concerns about interrupting ongoing conversations. Non-verbal cues and gestures are difficult to convey softly in a virtual environment.

Focusing on addressing these gaps in interactive experiences, especially those involving hidden psychological needs, can contribute to the evolution of online tools and mitigate the negative effects of virtual learning. This focus is crucial in redefining the design problem in future education, aiming to create effective and user-friendly interaction-based learning environments during the post-pandemic era, often referred to as the “new normal”.

Conclusion

A geographical change of the learning environment pattern has been witnessed during the pandemic. As an effort to better support the new traits, design thinking, especially the emphasizing, redefining and prototyping strategies, could help in adapting to the new surroundings. For the environmental change at the family and neighbourhood level, design could help in developing supporting toolkits or designing spaces for small-scale education and self-learning purposes. For the regional medium-scale learning experience, designers could focus on engaging learning solutions which may contain virtual reality technology and innovative virtual classroom settings. For an international grand level, innovations could be designs that help in enhancing international language learning on virtual platforms and creating a more equal access for learners from developing countries. New designs in skill exchanging platforms could also benefit learner's career life.

Focusing on filling interactive experience gaps and addressing the nature of humanistic social experiences, particularly those with hidden psychological demands, can help evolve future online tools and mitigate the negative effects of virtual learning. Utilizing empathetic strategies as a design thinking method can aid in comprehending real-life educational contexts during the post-pandemic era. It assists in identifying people's needs for exploring more engaging remote learning experiences while preserving the essence of traditional learning. The redefining strategy facilitates the search for innovative design ideas to create effective and user-friendly learning environments based on interactive experiences in the “new normal”. It emphasizes exploring people's tacit demands underlying their micro-habits and leveraging their pre-existing location-based memory to optimize their engaging learning experiences.

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How a Technology Identity Can Enhance the Diffusion of Good Design Practices in Product Sound Design

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Abstract

People are plugged into an intangible sound universe. But only a tiny part of the sounds we are exposed to have been purposefully designed. Recently, designers are bashfully approaching these intangible products' quality. Product Sound Design represents, in fact, a promising research field still scarcely explored. The design community is answering this concern through new design methods. An Italian university developed a patented method-and-tool, conceived to collect, analyze, and recreate various sounds to develop a new generation of products with designed mechanical (and, eventually, digital) sounds. Spreading this innovation within the design community is fundamental to stimulate future more focused and aware practices. As well as all new technologies, the new patent didn't have its own identity from the beginning. Extensive work conducted with the scientific approach has therefore been undertaken to redesign its identity to make its disruptiveness intelligible and understandable.

Keywords

Digital identity
Product sound design
SounBe
Technology identity
Virtual presence

Introduction

Nowadays, all over the world, people are plugged into an intangible universe made of sounds. The “soundscape” (Schafer, 1969) in which we live comprises communicative and uncommunicative, pleasing and unpleasing, useful and sometimes useless stimuli. What is commonly understated is that only an infinitesimal part of the everyday object sounds we are exposed to (e.g., the crackling sound of packaging, the rolling sound of an office chair, etc.) has been purposefully designed (Fenko, Schifferstein & Hekkert, 2011).

What is Product Sound Design and why it is so important

Products are ubiquitous, so are the sounds emitted by products. Every sound seems to influence our reasoning, emotional state, purchase decisions, preference, and expectations regarding the product and product's performance. Thus, auditory experience elicited by product sounds may not be just about the act of hearing or a sensory response to acoustical stimuli (e.g., this is a loud and sharp sound). People actually experience a product sound beyond its acoustical composition [...]: a complimentary and meaningful relationship exists between a product and its sounds. (Özcan Vieira, 2008).

According to the World Health Organization (WHO), noise pollution is one of the most dangerous environmental threats to health (WHO, 2018). It continues to be a growing concern among policymakers and the public alike. In addition to road traffic, railways, aircraft, wind turbines, and leisure noises, a need for updated health-based guidelines originated at the Fifth Ministerial Conference on Environment and Health (organized in Parma, Italy, in 2010), where Member States asked WHO to produce appropriate noise guidelines that would include additional noise sources such as personal electronic and non-electronic devices or toys (WHO, 2018).

All this evidence highlights how an up-to-date discipline, at the encounter between acoustics, design and cognitive ergonomics, is strongly needed. Product Sound Design represents, in fact, a promising research field, but one that is internationally still needs to be explored.

The Advent of New Practices for Product Sound Design

In recent times, designers are bashfully approaching these intangible products' quality. The design community is starting to answer this concern through new design methods. According to this, in an Italian university, a multidisciplinary team developed a patented method-and-tool named SounBe Fig. 1, conceived to collect, define, analyze, and recreate a variety of sounds, to develop a new generation of products with mechanical (and, eventually, digital) sounds (Dal Palù et al., 2018) as described in scientific literature (De Giorgi et al., 2011; Dal Palù & De Giorgi, 2018).



Fig. 1
An overview of SounBe tool.

SounBe tool consists of a set of accessories housed in a briefcase and designed to produce sounds from materials samples following a standardized procedure. It can be adopted as a reliable tool to generate sounds to be described also with semantic differentials technique, frequently adopted in sound quality investigation studies. SounBe is an evolving and open tool: as the complexity of gestures and exciting modes existing in real life and in real interaction between a human and an object, or between two objects, is almost endless, the device offers the possibility to reproduce several more common gestures, but the method can be implemented with new gestures still not explored. The physical device allows not only to test material samples but also to submit to the test simple and small products such as, for example, a coffee cup (Dal Palù et al., 2018).

Spreading this innovation within the design community is fundamental to stimulate future practices, especially concerning Product Sound Design. Moreover, the dissemination of SounBe method-and-tool could have a significant role and impact in the educational path of future designers and prepare them to be able to produce impactful changes in the development of innovative cognitive processes, and artifacts, in which sound will be a main asset. As well as all new technologies, the new patented method-and-tool didn't have its own identity from the very beginning.

Finally, this design-driven process was focused on the key questions proposed in the next lines:

- How to ensure that the SounBe technology spreads in the design community?
- What identity to give to the new technology?
- Can a new *phygital* identity (i.e., a new identity that mix physical and digital levels, aiming at the convergence between the two spheres (Johnson & Barlow, 2021) help spread physical technology on and off the web?

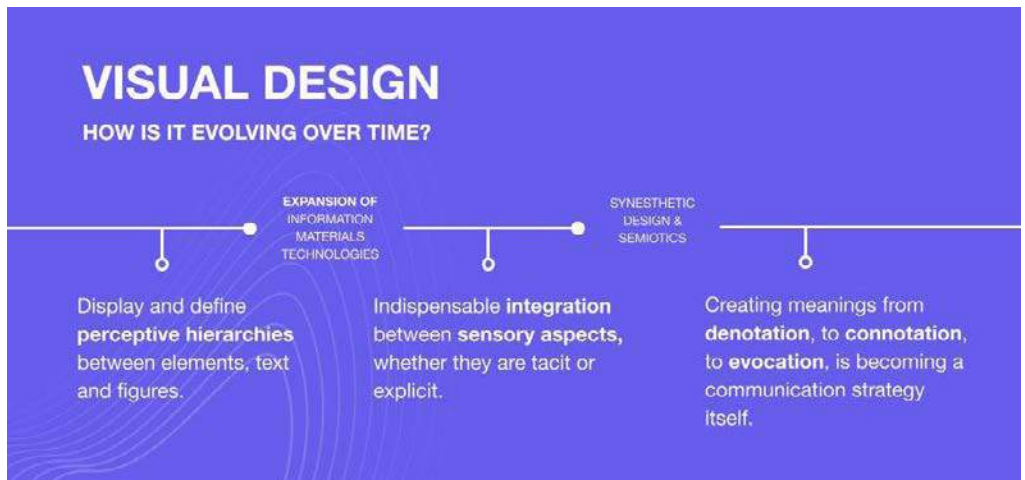
This contribution tries to show how a new technology developed to face a phenomenon attracting an increasing attention not only can benefit from a totally new and ad hoc designed physical and digital identity, but also how impactful this could be on the ideation, production, distribution, and regeneration of education (and of next generation products). A descriptive report of this process

is proposed, with the aim not to represent a possible method to be replicated, but to offer the perspective of a case study on the possibility of designing the identity not only of a product or a brand, but of a technology.

Scientific Approach

A new technology identity design is a matter that goes far beyond the boundaries of communication, user experience, and innovation. In the specific case of this research, the identity of a new technology can help spread its adoption, with a consequent positive effect on future product design practices.

The analysis of literature (Haverkamp, 2013; Riccò, 2016) defined a spot at the intersection between visual design and sound, and the integration with semiotics and the synesthetic approach is shown to be crucial to meet cross-sensorial needs. The subsequent sub-chapters, and the related approach schematization Fig. 2, will depict a clearer image about it, always in relation to the proposed case study.



A Communication Strategy Based on the Synesthetic Approach

Fig. 2
A schematization of the adopted approach.

Since products and services' identities shape their desirability, acceptability, and adoptability (Elwyn et al., 2013), they could positively affect future practices, especially those concerning product design.

Traditionally, visual designers seek to display and define perceptive hierarchies between writings and figures. However, as Merleau-Ponty (1945) declared, objects' aspects don't identify just in their geometrical shape but, instead, they are linked with the whole human sensorial sphere. Moreover, the expansion of information, materials, and technologies drives products to an indispensable integration between sensory aspects, whether they are tacit or explicit as many studies researchers confirm. The Italian designer Bruno Munari (1981), in the early 1980s, affirmed that design projects not

only should consider the senses other than sight but consider them as an essential linked entity. Multisensory integration turns out to be fundamental to meeting the users' cognitive needs, leading to more comprehensive design products (Chandrasekaran, 2017). The result is a necessary interdependence that, in this case, must take place between visual and sound stimuli (Ricco, 2008).

Even though the use of sight is normally perceived as the main sense faculty, other senses, specifically hearing, merge sharply with the sight to shape a consistent representation of the context we are immersed in (Liu, 2020). We will dive deep into the relationship between vision and auditory senses in the next paragraphs.

Visualization to Drive Perceptions

Despite the exploitation of sensory integration, especially with audition, visual-lead translation is still recognized as the most efficient method, on a communicative level, to let the users fully embrace the relationship between the senses (Liu, 2020). The designer can direct the characteristics of those interactions, defining sensorial priorities and hierarchies, to avoid inconsistencies (Ricco, 2008).

Thus, concerning visual strategies, the wise use of typography can drive human attention towards precise sentences, keywords, or lone glyphs to strengthen visual identities, logos or explanatory texts. Moreover, previous color associations and well-known brand identities shape our perceptions, establishing unconscious patterns in our mind. The latter react to shapes similarly, associating them with previous and personal experiences.

The Semiotic Principles of Design

Theoretically, objects or signs denotation is objectively perceptible, but its representation, instead, is an internal image that was formed relying on the memories of sensitive impressions and activities people experienced (Frege, 1892). Hence, this semiotic principle leads to the subjective connotation of a visual element, which changes according to each individual. Starting from this rule, the designer must consider the *denotative*, *connotative*, and *evocative levels*, both individual and collective, of a certain visual stimulus. Nowadays, the process of creating meanings from denotation to connotation, to evocation, can be considered as a communication strategy itself (Bonfantini et al., 2007) frequently exploited by media, visual merchandisers, and designers.

Visual and Auditory Stimuli: An Effective Interdependence

As a typical means of synesthetic translation, the audio description would enrich visual information, thereby conveying the emotions within visual content (Liu, 2020).

In broad terms, verbal and visual descriptions of the sound world require a figural language allowing the visual register to take immediate relevance. In addition, concerning harmony and melody dynamics, the sound vocabulary retains traces from the visual arts (Ricco, 2008).

Thus far, we illustrated the constitutional synesthetic principle on which the research and design of SounBe communication systems are based. In summary, sight and sound are in a constant relationship: from figures arise sounds (think, for example, of the famous “The Scream” by Edward Munch) and with sounds, we can evoke images. We must therefore not expect sounds *to be heard*, but sounds *to be seen, evoked* in the literal sense of the term.

In summary, while presenting the current project we intend to propose how an increasing sensory intervention would accommodate richer design elements and design issues where complexity plays an important role (Liu, 2020). By exploiting sight stimuli and psychological processes, a system of visual elements allowed the authors to reach significant results in terms of effectiveness within the creation of a communication strategy that could meet users’ needs as well as SounBe main features.

These approaches have been applied to ensure a wide dissemination of SounBe potentiality mainly online, but also offline, through an integrated communication strategy that will be disclosed in the next section.

First Outcomes

As we already said, the communication of the technology was based on a convergence between digital and physical spheres. After a due scenario analysis based on mood boards of the existing panorama related to sound fruition intended in a wide perspective, here only briefly mentioned through some examples taken into account Fig. 3, for the digital “showcase” of this technology, a coordinated image was created, as well as an identity on the website (www.sounbe.com design), and a communication plan through straightforward wording for the potential user (designers, researchers, companies), to make its disruptiveness visible and tangible, though online.

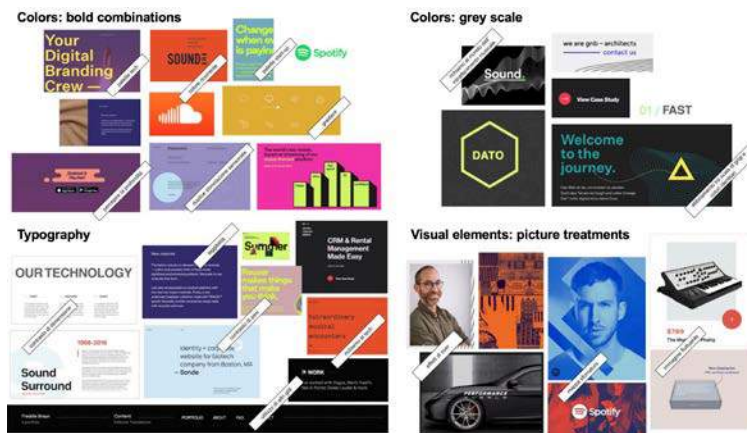


Fig. 3
A synthetic overview of the performed scenario analysis through a mood board of case studies taken into account on the theme of sound fruition in general.

Specifically, the multi-level communication of the instrument has been fully revised Fig. 4.

From the initial color palette, colors have moved to ones emphasizing the high-tech aspect of the instrument and the spirit of start-ups. The grayscale, colors of the technique, were flanked by bold combinations of violet (which refers to the blue of the University where SounBe was developed, but also to a more electric color, close to the world of innovation) and acid green (which winks at novelty and sensory stimulation). The gradient map in a combination of identity colors was chosen for the treatment of images, returning visual and narrative uniformity to the photographs chosen to tell the project.

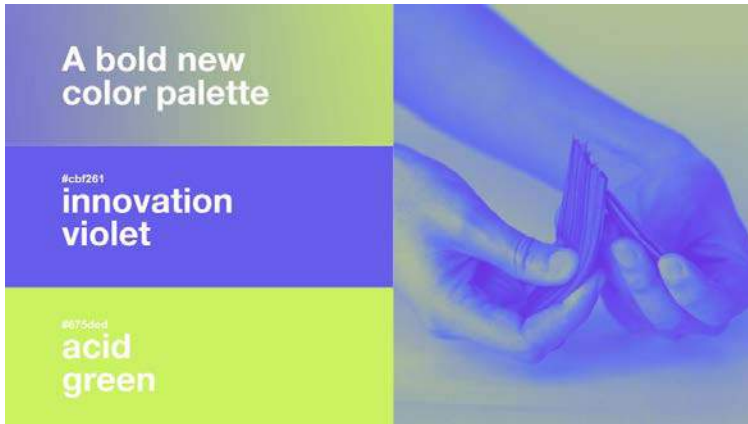


Fig. 4
An example of colors and coordinate image of the technology new identity.

The research subsequently focused on finding the most suitable shapes to tell the world of sound design. The choice fell on the visual imagination of sound waves, stylized to also resemble icons and shapes symbols of the most relevant application sectors for sound design. The result is waves evoking the reverberation of sound and remembering iconic products or silhouettes (e.g. luxurious bracelets or candy packaging) Fig. 5. The logo was the first ground for this new attitude towards shapes, designed to be constantly updated with different sound waves. The new dynamic identity has been completed with a typography that privileges the contrast of dimension between the texts, still in favor of high legibility, in combination with the use of some glyphs such as +, >, arrows. The choice of a sans-serif typography was almost natural, both for the technological context in which the project fits, and to be able to adapt more easily in particular to digital contexts.

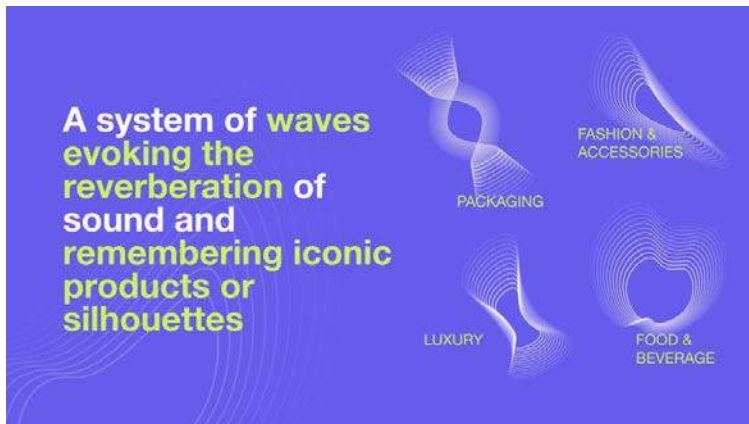


Fig. 5
The system of SounBe's sound waves.

The Showcase of the New Identity of Sounbe

The first context of application of the redesigned identity was the new website, conceived as a real “showcase” of the technology and developed through in-house design phases such as mood boards, brainstorming, cognitive mapping, experience prototyping, all performed inside the extended research team.

Thanks to brainstorming and participatory design with the project team, a vertical scrolling landing page was structured. This choice wants to be a metaphor for deepening the contents. The website is divided into sections, developing the story of the potential of technology, with a simple language and suitable for both simple curious people and designers and companies. Just as if it were a start-up, SounBe is also told, through its technical aspects, the advantages it can generate and the real services with which this technology can be exploited. In this narrative, a human component is not lost, thanks to the faces and stories of the designers who contributed, thanks to their multidisciplinary skills, to the realization of the tool and the services connected to it.

A New Awareness Thanks to Social Media

Social networks can also be leveraged to build a new awareness around sound design. The launch of the new SounBe website was in fact flanked by a social campaign dedicated to the interactions between the culture of design and the history of design with the world of sound. The story of some case studies, such as products with design peculiarities, winners of important awards such as the “Compasso d'Oro ADI”, or with a certain reputation and recognition, has been useful to generate interest and amazement around SounBe's technology, as well as to entice designers and companies to take an interest in this area. From a graphic point of view, a series of social cards were created in which it was possible to express the maximum of the visual identity of SounBe, using the sound waves, the colors of the palette and the onomatopoeias corresponding to the sounds that characterize each product presented. The result

is an operation that combines dissemination on the themes of the project culture, promotion of a technology that fits into a sector with great possibilities for development and the ability of good design to marvel Fig. 6.

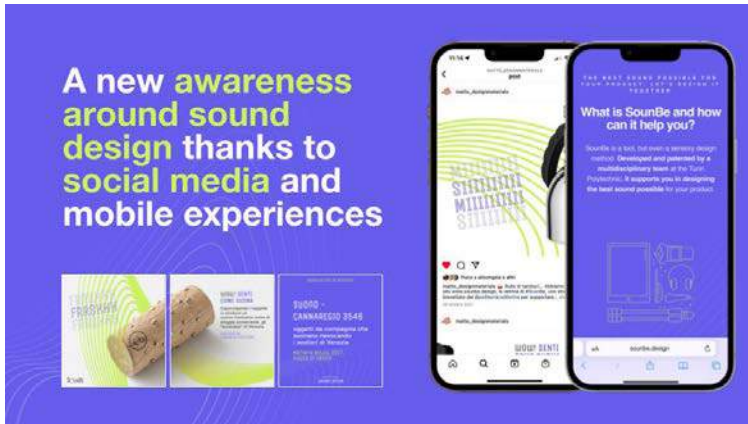


Fig. 6
SounBe's social media
and mobile experiences.

Reflections and Reasoning

It is the task of each designer to think about the future with a proactive approach oriented towards growth and continuous improvement. Similarly, the task of academia is, among others, to orient skills and abilities of the future professionals towards the most current challenges that society raises.

Rethink about our own learning and education frameworks and methods to prepare future designers having a significant role and impact on the emerging challenges affecting organizations and the overall society is a key activity of the academic design community. In fact, a non-hegemonic approach to design education could introduce new perspectives on the future of experiences, opening to a more collaborative, inclusive, transdisciplinary, and collective learning system.

The Intelligibility of a New Technology: A Key-Asset

The design-driven innovation is crucial in driving new ideas and new technology; D to D (i.e., Designers to Design) innovations are currently developed more and more (Dal Palù, De Giorgi & Lerma, 2014). Recent research shows how industrial designers might be able to effectively support scientists and technicians in their research activities to foster an effective collaboration (Driver, Peralta & Moultrie, 2011). Unexpectedly, the role of the designer as a key-driver of innovation seems to be underrated by designers themselves, although research in design appears to be anyhow a powerful resource.

In the case of this contribution, the technology was developed by a multidisciplinary team that includes designers at the service of design, and even the technology identity and presence has been developed to convey its adoption and to catch the attention of a design-led public (confirmed by a progressive and growing interest in the technology, obtained since the launch of the communication strategy).

As we all know, the adoption of innovative technologies is nowadays conveyed more and more by the online communication channels. Also, for this reason, a *phygital* technology identity was strongly necessary. In fact, the “physical + digital” dimension was considered the proper space in which the diffusion of SounBe technology could take place. This case study could represent a first reference for other multisensory communications of new technologies identities through the *phygital* medium in the Sound Design sector. However, in this sense, attention to this contribution should not fall only on *how* the project of the new identity of the technology in question (which represents a simple case study) was resolved, but rather on *why* it is important to focus attention on this aspect. In addition, this example raises another debated point within the design community: the necessity to consider the designing of the correct identity of a new technology as a stage of the TRL scale, to strongly convey its adoption.

A New “Sensibility” Within the Design Community

Making a new technology understandable — without the pretension of bothering, however, the adjective *accessible* — is more than creating its online showcase, it is making its potential available to a larger number of possible users. The identity of a new technology can help it to be more inclusive (for instance helping to connect it to its early adopters), and include people who are normally excluded by rapidly changing technology (Langdon, Clarkson & Robinson, 2007). Moreover, in the case of the SounBe communication system, it can also help to rapidly understand the context of use and the complexity of the interactions made possible.

Thanks to its designed identity, the new technology can enhance the diffusion of good design practices in the project phases such as designing the invisible aspect (Ferrerri & Scarzella, 2009) of Product Sound. Specifically, it defines new perspectives on the future of experiences, opening to a regeneration of education in the direction of a more collaborative, inclusive, transdisciplinary, and collective learning system: a new responsible knowledge that aims not only at improving the discipline, but also at an internal and external wellbeing of the ecosystem.

This future focused practice appears finally to be in line with the words of Reynold Murray Schafer, soundscape theorist, who affirmed that

It devolves on us to invent a subject which we might call acoustic design, an interdiscipline in which musicians, acousticians, psychologists, sociologists and others would study the world soundscape together in order to make intelligent recommendations for its improvement. [...] The final question will be: is the soundscape of the world an indeterminate composition over which we have no control, or are we its composers and performers, responsible for giving it form and beauty? (Schafer, 1977).

Conclusion

From the snap of a chocolate bar to the rustle of a luxury silk shirt, the sound is becoming increasingly relevant. The goal of spreading sound design culture is now becoming more possible thanks to a tool at the service of designers, whose disruptiveness was difficult to understand. Bringing SounBe and its identity back into the world of sound design, investigating its key traits with respect to colors, typography and visual elements was necessary to increase its accessibility. This operation could be seen as an example of a way to “educate” the designer to future focused practices and reconnect the technology to potential users, with the overall goal of spreading the new practice of Product Sound Design within the design community for the future.

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Learning and Teaching From and by Social Media. Instagram to Support Blended Learning Models

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Abstract

The experimentation discussed in this article investigates the relationship between design studio teaching and visual social media. It implements an experiment on Instagram as a channel to build a “social” form of the augmented classroom. Technologies are considered here from different points of view both as a platform for interaction and sharing of information between teachers and students and among the students themselves, as a channel to support the different project phases and last but not least, as a creative stimulus. The research presents some results of ongoing experimentation within design courses on using a social platform, Instagram, as a channel to support teaching activities used as a highly visual medium, stimulated student learning and facilitated teaching through dialogue, engagement, and interaction.

Keywords

Design studio
Digital communication
Social media
Hybrid learning
Design education

The Relationship (Or Even Dichotomy) Between Communication and Teaching

In recent years, we have increasingly witnessed the pervasiveness of social media, which have taken on the role of personal communication channels, but above all, as tools capable of defining engaging modes of interaction between companies and consumers, institutions, and users.

In the different areas of creativity, “visual” social media (especially Instagram) have increasingly consolidated their role both as sharing channels and a tool that allows cooperation to create new ideas, entering the sphere of technological communication tools, typical of active approaches (Linfante & Manciaracina, 2021).

Educational communication represents a particular case of human communication, characterised by two processes, teaching and learning, and generally asymmetrical and intentional. Education has always passed through the communicative processes that regulate the relationship between teacher and learner, allowing the transmission from the former to the latter of cultural contents, behaviours, and ways of reasoning, which is the natural outcome of an educational and social relationship. The relationship between didactics, communication tools and technologies is inherent in the very concept of education because any communicative relationship between subjects with different degrees of competence can be educational. In this sense,

the transformations that have occurred in the processes, tools and forms of communication also have repercussions in the field of education, where there is a weakening of the functions performed by traditional institutions and a greater investment of the new generations in the media (Weaver & Cotrell, 1986).

Without the appropriate communication tools, there is no access to knowledge, either through actions of imitation or through more complex actions of elaboration and reorganisation of the information received. In fact, following Skinner's thought (2008), the first level of learning occurs through imitation, through processes of systematic two-way association. At the same time communication is also a set of rules that the learner must progressively discover and elaborate; in this sense, following Chomsky's perspective (1966), communication becomes an active and creative process.

Hence, effective communication strategies are becoming more and more fundamental (Orefice, 2005) for the optimisation of the education and learning process. Effective communication is indispensable for developing new skills and competencies for creating constructive relationships within the class group and the school community.

Moreover, it should also be considered that thanks also to the opportunities offered by the implementation of digital technologies and channels, training can be carried out through the exchange of messages in four different forms: diachronic (with time intervals) or synchronic (at the same time), in physical presence or not.

It is interesting to observe, for example, that television, in Italy during the economic boom, became an essential tool for the literacy of millions of Italians. RAI, anticipating in a certain sense the concept

of *edutainment*, on November 15, 1960, aired the first episode of *Non è mai troppo tardi*, a program created in collaboration with the Ministry of Education, curated and conducted by the elementary school teacher Alberto Manzi and broadcast for about eight years. It was designed to educate the adult public through the new television media increasingly present in Italian homes (Manzi, 2017).

In a certain sense, the experience of *Non è troppo tardi*, even if “unconsciously”, introduces concepts and methods that are incredibly relevant today, such as the school without backpacks or MOOCs, and on the other hand, reinforces the importance of the role of the teacher. In recent years, technological innovations in communication have been welcomed as disruptive innovations that would have overcome and replaced traditional forms of teaching.

The Role of Communication Technologies in Today's Fluid Context

It seems appropriate to think of technologies as potential agents of change, capable of influencing the educational setting and, ultimately, the learning process. New technologies need to be integrated with extra technological conditions that need to be set up for this to happen. The introduction of technology is bound to dry up in the short term, and technology should be seen as a resource capable of bringing out new forms of didactic planning. As Calvani (2000) states, the conquest of higher levels of reflection represents one of the essential contributions that technologies can provide to learning.

It thus becomes essential to understand that to establish and carry-on good dialogue, it is necessary, even if not sufficient, to know how to use multiple modes of communication, allowing both the teacher and the learners to implement a “mix” of communicative exchanges. The teacher should be able to train the students' communicative competence, whose learning is closely linked to the behavioural and communicative model used (Zannoni, 2009). Considering the above, therefore, digital technologies and channels can offer multiple possibilities to:

- improve and increase the communication modes between teachers and students;
- create a circular system of interaction between teachers and students;
- stimulate the active participation of students in the learning process;
- implement new modes of design and creative stimulation.

Digital technologies (fluid and multifunctional) can be considered more effective tools to support teaching and learning. They allow faster interaction between teachers and students and among peers. Still, they offer multiple solutions to enrich educational activities and potentially define a new meaning to the Net as real support of the learning experience (Sancassani et al., 2019). Understanding which resources to use and how to use them is nowadays as fundamental as it is critical. Still, these resources can add value to the teaching experience, impacting the course and developing digital skills and competencies that could be applied in working environments.

But it is once again important to remember that their introduction into learning processes can only produce positive effects if the different variables at stake are taken into account: such as the type of course, the Expected Learning Outcomes, the subject matter, student involvement, group participation, connection and interaction with the real context, receipt of feedback from teachers and peers (Sternberg & Preiss, 2005) and, not least, students' prior knowledge of the tools and channels. Using a device that users already know could leverage the instrument's potential without facing the resistance that often arises when new technologies are introduced. And social media, among the most familiar tools for students and increasingly for teachers, has become, in this sense, an interesting stimulus for the design of new forms of teaching mediated by technology. Considering the inevitable pervasiveness of social media and digital in general (accelerated by the pandemic), the research project was set up as a reflection on the unexpressed opportunities of some tools, now in daily use, such as Instagram. Thus, following what Roberto Casati expressed (2013) we have not considered that form of progress that comes about when we first look at the use and then look for the right technology to support or assist it. Digital and social media, and Instagram in particular, in this context, can represent an interesting field of experimentation of an undisciplined form of didactics (Marshall & Bleecker, 2010) to test ways and processes capable of defining a form of self-transcendent (Scharmer, 2001) knowledge. Consequently, the teacher and the student, potential Digital Masters who give life and build content through technology, are increasingly important (Casati, 2021).

Before getting into the merits of the experimentation, it is crucial to define some of the main functions of Instagram, their nature, and possible uses to better frame the reason for this choice. The main functions are:

Timeline:

The Timeline is essentially the profile. All posts live on the Timeline and are visible whenever someone clicks on the profile. The Timeline is where people will quickly get an overview of all posts.

Main Feed:

The main feed is the first thing visible when someone opens the app; this is where you can see your followed accounts.

Thanks to Instagram's algorithm, the user mainly receives content to engage with frequently. This is where community interaction begins, and it's where you can engage with the profiles you follow to build a direct and ongoing relationship.

Post:

The post is the generative module of Instagram. It is the first feature implemented, which allows you to share pictures or short videos on your profile Timeline, typically long-lasting content because it will remain on your profile Timeline. In addition to photos and videos, you can insert short texts, tag people (draw their attention through their profile on the image) and insert locations or hashtags. In posts, you can share single photos, sequences of images (up to a maxi-

mum of ten) and short videos, allowing the creation of a sequence of contents that can enrich the browsing experience and implement different types of content.

Stories:

Instagram Stories are a space where you can create more extensive, richer content by uploading photos, creating content like polls, sharing content, or posting short videos. Stories are “live” for 24 hours, then disappear for the public (but they also live in the archive). Stories are a way to engage with your audience more deeply and more frequently. They are also a great place to get feedback (via polls); use the Ask a Question feature to interact with your audience for fun and feedback and encourage them to share your content when you post shareable things. You can use stories to link to external content with the See More/Swipe Up feature.

IGTV:

IGTV is a long-form video space viewable in the Instagram app that allows you to upload longer videos than stories and posts. It is a place to upload video tutorials, Q&A sessions or interviews (like recordings of an Instagram Live or webinar), creative content like behind-the-scenes footage or streaming an event.

Reel:

Instagram Reels are 15-30 second multi-clip videos with sound that are editable with effects and tools to make them interactive and engaging. They’re essentially Instagram’s answer to the popular TikTok app. You can make these videos directly on the app or upload some you’ve previously created. Viewers love watching fast clips and endlessly scrolling through reel content. Instagram Reels capture a wider audience than TikTok, as not everyone may be comfortable using the TikTok app. These reels can be informative (like how-to or tutorials), funny, impressive, or even filmed talks.

Instagram Live:

Instagram Live is a feature that allows you to broadcast to followers live. Going live is a way to connect with your audience in real time. During a live broadcast, you can share reactions or have chats. It is also possible to go on Q&A to answer questions from the audience.

Highlights:

Highlights are an area where you can group your past Stories. They live permanently on your profile as curated collections of your stories that followers can watch anytime. Highlights allow people to quickly find information about previews of content shared in Stories.

Save:

Save is a feature that allows you to save any post you see while scrolling through your main feed or searching for an account on Instagram to view later. This is a way to gather inspiration, save ideas in folders, and organise competition, prospects, and inspiration.

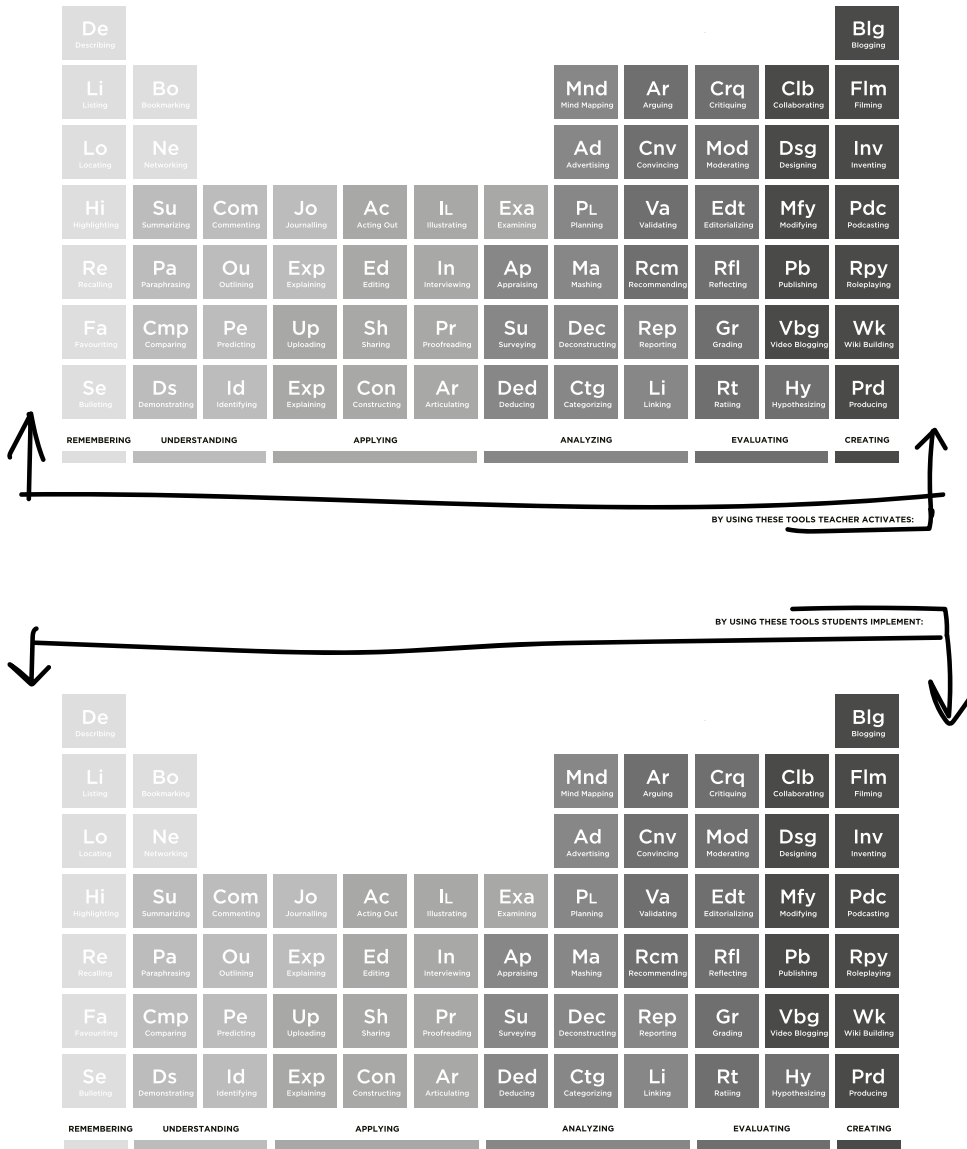
Considering the review of the literature on the evolution of design education and the development and use of new technologies in education, as well as considering the pervasiveness of social media in everyday life and many creative fields and finally, considering the results of some case studies of applications of Instagram in education, we proceeded to develop the experimentation within several design studios in the Fashion Course of the School of Design of the Politecnico di Milano, during the academic year 2020-2021.

The first two experiments were carried out during the first semester in the Metadesign Studio in the second year of the Degree (46 students) and the Textile and Print Design for fashion course in the third year of the Degree (31 students). The second part involved two Visual Communication Design Studio from the first year of the Degree (85 students in total) and two Fashion *Retail* Experience Design Studio from the first year of the Master's Degree (77 students total).

The choice of this type, of course, all of which are project-based, was made to experiment with a highly visual social platform, such as Instagram, as a tool:

- to deepen and explain contents presented during the lessons
- to support the understanding of the design process
- to stimulate creativity
- to share information
- to facilitate peer-review
- to share the different design and creative processes of the students

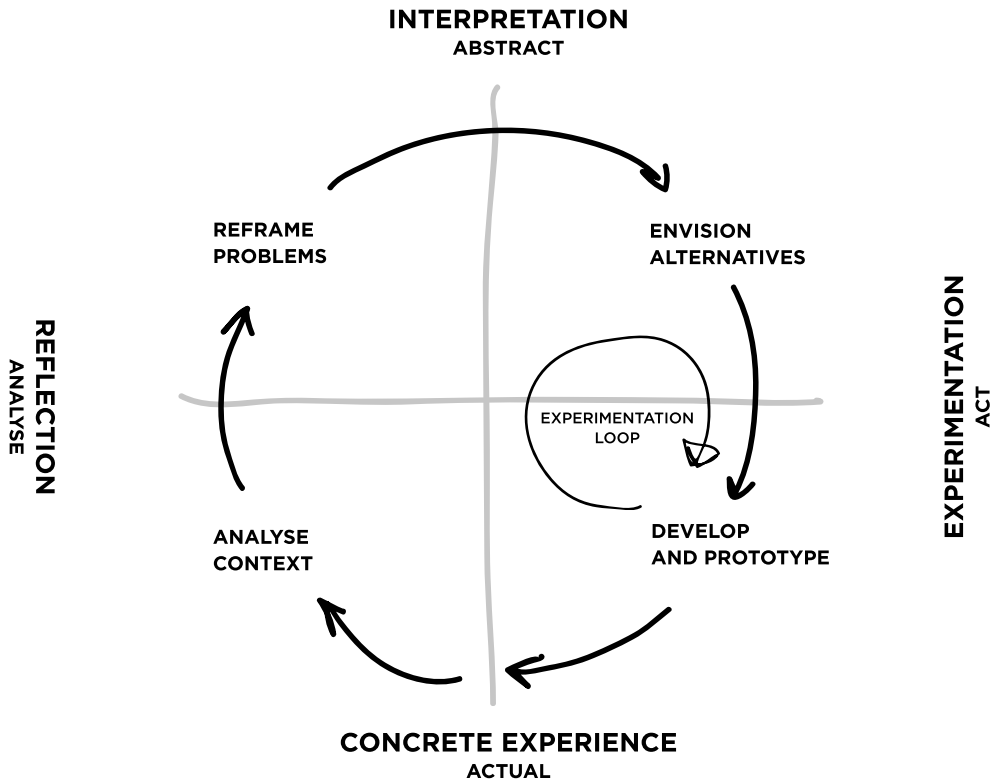
In defining the experimentation, it was considered an iterative process well described by the framework defined by Rizzo, Deserti & Pous (2017). This is a framework that combines experimentation and learning, integrating the methodology of Design Thinking (Brown, 2009) in the form of an iterative design process with Kolb's cycle (Kolb, 2015). This approach is based on the idea that design processes can be leveraged to create and drive experiential learning within organisations. This model helped shape an iterative form of the design process, based on cycles of understanding design and redesign that integrate with the situated nature of experiential learning. The "4A" model was applied here, which, starting from the concrete experience of the current situation (Actual), moves towards the design of experimentation (Act) by reflecting (Analyse), interpreting and imagining different alternatives (Abstract).



The experimentation phase has given form to various models representing the concrete implementation of the formulated hypotheses concurring. Therefore, it is possible to estimate their effectiveness, have feedback on the hypotheses, and refine the solutions. In doing so, we designed and prototyped new solutions in real contexts (the courses examined). In doing so, course after course, we proceeded both by modifying methods and tools, and by implementing new forms of tools and actions, and abandoning actions and tools results, all thanks to the comparison with the teachers of the various courses, the results of focus groups of surveys with students.

Fig. 1
The design-based learning framework map the DT cycle with Kolb's model (2015) of reflective learning. 2017. Ph. Rizzo et al.

The modalities, profiling and results of the experiment (Linfante & Manciaracina, 2021) led us to analyse the different points of view of the users (student and teacher) concerning the activities conducted and tools implemented, considering the Bloom Taxonomy Periodic table (McNulty, 2020).



It is interesting to underline how it is possible to cover almost all the levels of Bloom's Taxonomy with a mix of the different tools. Another element to be considered, and not to be underestimated, in defining a model based on a social approach to teaching is the time variable. It is crucial, in fact, not to lose sight of the objectives and timing of the project to stimulate adequate action or response at the right time and optimise the opportunities offered by the agile and informal mode of interaction typical of social media.

In light of this last consideration, maybe we could implement a new form of interaction between teachers and students, considering teachers as Social Media Managers of the course and students as Content Creators.

Fig. 2
The Bloom Taxonomy Periodic table was used to analyse the actions implemented by the students in the different phases of the design process. This tool was constructed considering both: the actions implemented in response to the stimuli received from the teachers and those implemented when the students were directly involved in the creation of content on the social channels of the working groups.

Teacher as Social Media Manager

In the context of social media-assisted teaching, the teacher can thus consider social media as an additional tool for structuring more effective and persuasive didactic actions and, at the same time, for stimulating more active participation by the students in the different project phases. In this sense, considering the increasing pervasiveness of digital communication in the educational sphere and various design fields, social media has become not “the” solution but an opportunity to be exploited. Therefore, teachers need to understand and manage the potential offered by social media to use them effectively, borrowing and transferring some of the characteristics and strategies typical of the activity of a social media manager within the educational process.

The teacher becomes an ever more key player, the one who not only defines ILO and course structure but also becomes the one who manages the online presence of a course by developing engagement strategies, producing content, analysing usage data, and facilitating the different stages of class learning.

To summarise, in addressing a course using social media, it becomes crucial for the teacher to be able to:

- Develop creative and engaging social media strategies;
- Manage the course social channel periodically;
- Periodically supervise group or class channels;
- Plan and deliver effective content for different project phases;
- Create engaging multimedia content (and/or outsource it effectively);
- Manage and facilitate the classroom and students by responding to social media posts and developing discussions;
- Monitor, track and analyse the results of any quizzes or surveys and the various interactions implemented across the course and group channels;
- Keep up to date with the latest trends and techniques to find new ways to engage students
- Educate the class on the conscious use of social media;
- Encourage collaboration among students (inside and outside the social platform).

Although this list may seem, at first sight, far from the role of the teacher and provide a series of actions that further complicate and burden the already complex work of teaching most of the actions and features listed are nothing more than a digital and social form of actions and activities that should already be implemented during traditional teaching. Involving, managing, supervising, planning, creating content, facilitating, monitoring, analysing, and encouraging collaboration are essential elements for the realisation of effective teaching in general.

Student as Content Creator

In social media-assisted teaching, the student also expands the range of actions and skills they must implement and manage. On one side, in the interaction with the course channels (managed by the teacher), students realise the typical dynamics of followers. On the other side, when students actively manage the group or class channel, they implement skills specific to the figure of the Content Creator, someone, responsible for defining the content and presenting it in the most appropriate and effective form.

To summarise, in addressing a course using social media, in addition to defining the project required by the course, the student implements the following actions:

- Develop the communication project, defining the recipients, the objectives, the type of language, the contents, the graphics and any multimedia contributions, etc.;
- Coordinate textual contents and images defining a visual identity of the project;
- Periodically update the contents according to the teachers' requests and the different project phases.

Although managing a group or class channel is an additional task, the students stated that the effort required is manageable during the focus groups. This is also because the students demonstrated higher confidence and speed in handling the tools and dynamics of social channels.

Conclusions

This research aimed to investigate the effectiveness of the use of Instagram in particular, but more generally, of the typical dynamics of social media within a teaching activity. This research assumes that social communication is defining itself as an increasingly significant element not only for the staging and narration of all creative systems. The digital transformation drives new visualisation, promotion and storytelling processes of the design system, defining new relationships between physical and virtual spaces in which users are not just spectators of the creative phases but are increasingly involved in processes of "value co-creation" and "cooperative investment". Within this framework, the digital channel seems to offer an opportunity not to be missed for implementing innovative hybrid and interdisciplinary learning models. Thanks to the web spread in extensive networks, social media and social networks highlight social and collaborative character. It is also a place that erases the space of the here and now by extending the places, methods, tools and times of learning.

Thus, it is essential to highlight that the effectiveness of the various actions depends on the correct use of social channels and the definition of the content by the teacher-social media manager. Regardless of the subject, the design, planning and organisation of specific learning activities supported by social technologies become central.

Regardless of the learning environment, it is essential to remember that people learn best when actively involved. It is, therefore, necessary to structure the different activities according to a flow

that can support effective learning. Furthermore, the implemented learning sequences and structures must be constructed to be easily repeated, shared, reused and implemented later and in other contexts. It is therefore important to:

- define which tools to use according to the teaching purposes;
- plan a proper workflow;
- structure the different activities, contents and resources needed;
- schedule a timetable in such a way as to be able to involve students effectively;
- verify the process implemented for possible modifications and improvements.

Central to this phase is the need to abstract the learning process experienced to make it usable and transferable in such a way as to allow its easy reuse and implementation in the future. The attempt, for future research developments, is to define tools and processes to create different scenarios that can be of reference for teachers as creative support to design and structure educational activities and provide tools for further experimentation to be shared and reused on future occasions (Manciaracina, 2022).

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Education & Practice in Open Design. Improving the Learning Experience Through Knowledge Connections

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Abstract

Learning complex disciplines traditionally requires the adoption of equally articulated methods and strategies. Design does not escape this principle, on the contrary it enhances some of its peculiar characteristics: very different skills, often not aligned development and application times, tools complexity, declare an environment where methods and practice had always defined a non-linear educational scenario (Cenamo et al., 2011). The paper discusses the matter while bringing a case study specifically defined with the purpose to test a new educational scenario where a student is put into conditions to experiment the entire Design process by himself, being connected with different competences inside a complex multidisciplinary environment, in order to develop a physical Design solution for a user with disabilities.

Keywords

Open design

Multidisciplinary education

Fablab

Digital fabrication

Local production

Introduction

Learning complex disciplines traditionally requires the adoption of equally articulated methods and strategies. Design does not escape this principle, on the contrary it enhances some of its peculiar characteristics: very different skills, often not aligned development and application times, tools complexity declare an environment where methods and practice had always defined a non-linear educational scenario (Cennamo et al., 2011).

This is even more true if we consider the operational aspects in the practice of “making”, where good design is realised in the prototype phase and then in the production of artefacts, smart devices, vehicles, or any other product of a process, whether physical or non-physical (Admiraal et al., 2019), or even services rather than communication content. Taking the case of Enzo Mari as an example could be considered banal, yet valuable for his contribution to the thought of a Design for All approach and set of methods, in which the person becomes actor of the process itself, thus determining the practice and the final result (Ryan, 1997). What this approach implies, however, is the necessary awareness of the complexity of Design in its overall path, from the initial need to its solution in the final design result. This complexity, of course, resides within the numerous disciplines that, today more than ever, are essential to the concretisation of the design process; this articulation of different knowledges becomes a primary educational necessity, especially considering the urgency of the environmental, economic, social, and cultural problems that we must face every day.

In fact, the possibility to invest time, money, competences and, at last, our global effort into a different approach to production of artefacts could lead us to a different story, where production is not anymore related to some other place, some other country, but instead it is strictly interconnected with local activities. Which is, at last, one of the more effective strategies to intervene into a global world, where global problems produce global negative effects, however much more damaging countries where production benefits do not belong to.

Didactics Transformations and an Effective Strategy

Hence the need to significantly transform didactics in Design, which like all disciplines has seen over the years an increased sensitivity in this direction, with operational actions experimentations, sometimes very detailed (Sancassani et al., 2019); this condition depicts a clear direction, already outlined by the principles of Systemic Design (Sevaldson, 2013), where outputs of a system become input of another, in a continuous, flawless process.

Systemic Design implies, moreover, a new attention to the values of local production, not opposed but juxtaposed to global production, whose advantages cannot be hidden by the negative effects produced mainly by the flattening of territorial specificities, bent to low-cost production, to the advantage of some geographical areas, while being detriment of many others.

As given by Anderson (2013)

under somewhat different historical conditions, firms using a combination of craft skill and flexible equipment might have played a central role in modern economic life—instead of giving way, in almost all sectors of manufacturing, to corporations based on mass production. Had this line of mechanized craft production prevailed, we might today think of manufacturing firms as linked to particular communities rather than as the independent organizations that, through mass production, seem omnipresent (p. 69).

One last element must be introduced, however, specifically in the field of information, being it the basic ingredient of knowledge: if it's true that a key element of the transformations we are talking about is the connection of knowledges, then it is necessary to rethink the principles on which we base the transmission and sharing of content, specifically referring to what we know about a subject that is undergoing design investigation. It means opening to diverging logics, somehow distant but not in contrast with traditional intellectual protection, certainly not to violate the rights of those who develop such knowledge, but on the contrary to enhance their identity on a local and global level.

Complexity, global issues with local effects, the need to extend skills, access to knowledge, enhance localisation by consciously exploiting the global network: these are challenges that, in order to be addressed, cannot but pass through the filter of a multidisciplinary approach, of interconnections between different knowledge, to be learned in the field, even before the level of higher education (Admiraal et al., 2019).

In fact, this set-up has the possibility to be enabled immediately, on a solid and dynamically evolving basis, by bringing the contemporary Designer closer and closer to places, methods and people who are already working on these fields, i.e., exploiting the Open Design movement, which through the Makers in Fablabs communities has been active for over three decades in the field of local, digital, interconnected and shared production (Anderson, 2013).

While it is true that Fablabs and Makers have existed for so long, it is also true that they have never really emerged in the field of practical and effective production, and this is not so much due to wrong choices or strategic errors, but more incidentally; it is to highlight a structural difficulty in adhering to globally standardised models of production, which badly intersect the trajectories of local, digital and interconnected action of Makers. However, curiously enough, this problem crosses the road of globalised production, making it critical within contemporary society, especially considering the environment issues and the social balance urgently needing to be restored on a global level.

Is it a good opportunity, then, to act in synergy between the level of global tradition and local innovation? The easy answer is yes, but it requires to rethink the training of the Designer, who can no longer follow traditional paths (Silva Pacheco, 2019). It is necessary to restart by experimenting new ways of learning the discipline of Design, experimenting in the field the practice of interfacing with other knowledge, whatever it may be, necessary from time to time to the cause of conscious design.

Case Study

The case study Design environment of the *Gamelon Pad* project, developed within the research activities of the Open Design group, where Making and Local Production connections are experimented, as part of the *virtuaLAB* (Politecnico di Torino) activities, in collaboration with *Fablab Torino*.

The objective of the project is the practical experimentation of the principles of Open Design (Aparisi et al., 2021), through the methodologies of local production, with digital fabrication tools, but above all in connection with networked knowledge strictly related to specific needs. In detail, the project addresses one of the areas that best match the principles of enhancing the Design for People, to support their needs, especially when these are particularly important, such as the inclusion of subjects who otherwise could not enjoy specific experiences due to disabilities of various kinds (Peng et al., 2022).

Disabilities are inherently challenging (O’Kane, 2016), because they are always particular, not easily framed in standards, commonly specified and designed for people without disabilities. For this reason, they are an ideal case for experimentation, due to their specific complexity and, above all, to the fact that the traditional approach has clear difficulties in meeting these specific needs.

In detail, the purpose of the research consists in the development, up to the level of a local, personalized production, of a game controller device, a gamepad for video games adapted for use by people with orthopaedic/motion disabilities, or generally related to the sphere of body movement.

The disciplinary scheme of the project Fig. 1 represents the inclusion of the methodological aspects of Open Design, orthopaedic/motion skills, hardware and software technological expertise, 3D virtual modelling and digital additive manufacturing.

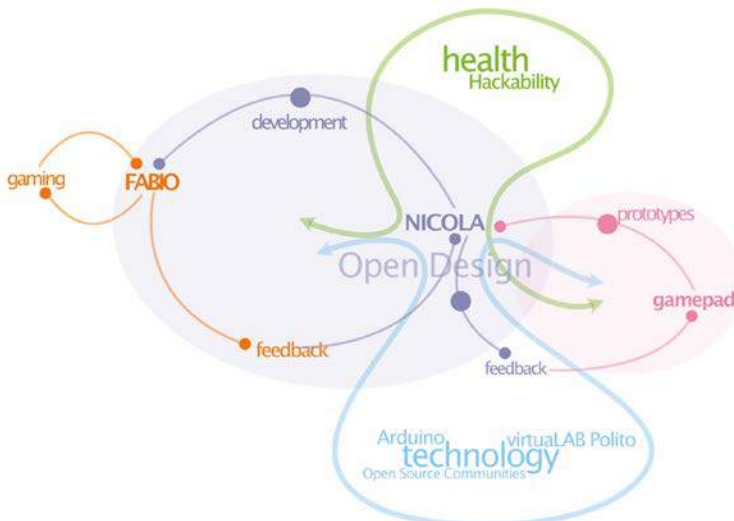


Fig. 1
Gamelon Pad. Methodology scheme with Design process and disciplines. Scheme, by F. Valpreda, N. Scalzotto.

What characterises the project, however, is the fact that all these skills have been acquired by drawing them from the experts in the field by a single student of the bachelor's degree in Design and Communication of the Polytechnic of Turin. This choice led to the definition of an experimental didactic scenario specifically useful for the purpose set beforehand, that is the verification of the initial hypothesis (Tsoumpri, 2019): is it possible to train new designers who are able to provide the whole process, making conscious use of related skills, digital fabrication tools, verification and multidisciplinary validation tools, at a local level but always in connection with the global network?

The design experiment led to define the acquisition of specific skills and experiences provided in order to make the young designer able to develop such a complex device.

Before delving deeper into the design process, it is necessary to understand what the methodological process followed was and in particular who are the actors that influenced it. The project revolves around the hypothesis that when dealing with disability-oriented design, structuring it as a linear process, from designer to user, is reductive, if not counterproductive. This is because of the intrinsic diversity of the world of disability, which is therefore complex, if not utopian, to group or define in categories without partially distorting the needs of the individual. To solve this natural criticality in this context, the Maker takes over, helping to define the solution for the individual and through an Open-Source circuit (fundamental in opening a direct modification channel with the peripheral, useful in mitigating the complexity), provides feedback by expanding the gamepad's range of performance. If this process can be assumed to be valid at the moment of commercialisation, it is also valid in defining the interaction with the project and all the development upstream, in creating the right logical process so as not to run into a solution that is too generic, i.e. traditionally industrial, but neither is it too specific and anchored to the end user (in this case Fabio, the project tester). The process is called "two-entry", or more correctly "two-roles". There is an initial phase where a gamepad is designed focusing on providing a set of possibilities derived from the analysis carried out on the scenario (pathologies, symptoms, kinesiology, existing peripherals, etc.), not at all different from the process commonly carried out in didactic exercises where questions hypothesised by a usually wide-ranging scenario are answered. This is followed by a subsequent phase of confrontation with the user, playing the role of Maker where the possibilities offered by the gamepad are used, extending them, modifying them, shaping the solution to meet the needs of the individual (in this case Fabio). This step is made more solid by the simultaneous collaboration with different subjects, between virtualLAB Polito and Hackability. The role of the Maker, interpreted in a temporary key during the confrontation with the end user, is a hybrid designer/producer/intermediate user (intermediate prosumer), since in order to design the final solution, the gamepad itself must be conceived in the beginning for its role of fruition and modification. A useful abstraction to understand these two roles is to imagine them as two separate and distinct persons: a designer endowed with the know-how necessary to design an artefact from scratch, and a Maker endowed with the equipment but not the knowledge necessary to

design the peripheral from scratch, and a boy with a disability (user), who only communicates with the Maker. The designer asks the question “how can I design an inclusive peripheral that can respond to a range of hypothesised scenarios? That is also accessible to the Maker to modify it with his tools?” The Maker in turn asks “How can I modify this component to meet the needs of the user? What should I report as a criticality of the peripheral to the designer?” According to this logical process, general needs arise first, into which the needs of the individual (Fabio) are then inserted. The world of video games is vast and complex, so also the end user. He has an active role, he performs a fundamental verification action to effectively respond to the complexity of the two worlds, video games and disability, by determining the times and means necessary to provide feedback. The user’s feedback is not lost the moment it reaches the Maker but is translated into performance and included as a modification in the gamepad circuit. The user in this context is not only the person with a disability but often also his or her support sphere (a counsellor, his or her therapist, etc.) who can contribute fundamental feedback, adding value to the network of competences necessary for the development of a complex project.

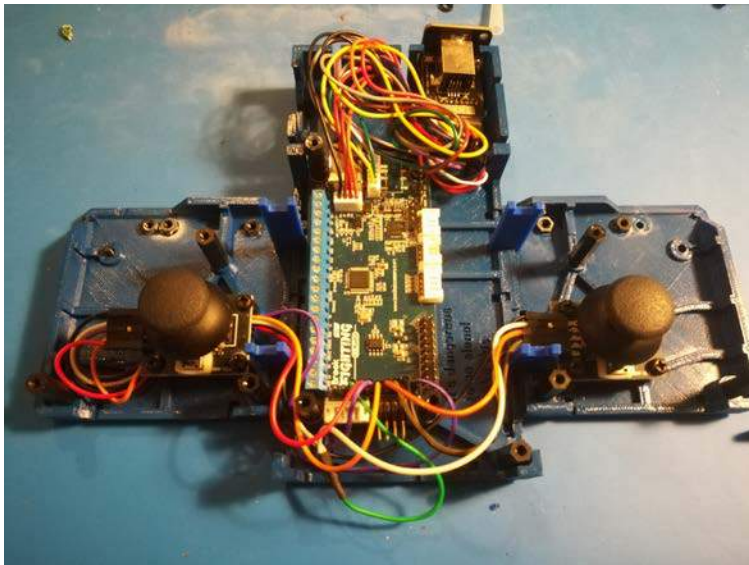


Fig. 2
Gamelon Pad. Hardware developed, prototyped and tested by Nicola Scalzotto. Photo, by N. Scalzotto.

The results achieved Fig. 2 offer a quite promising picture, certainly returning operational functionality to the subject undergoing experimentation, but above all showing that the student designer has been able to follow the entire path by personally completing every single step of the design, prototype Fig. 3

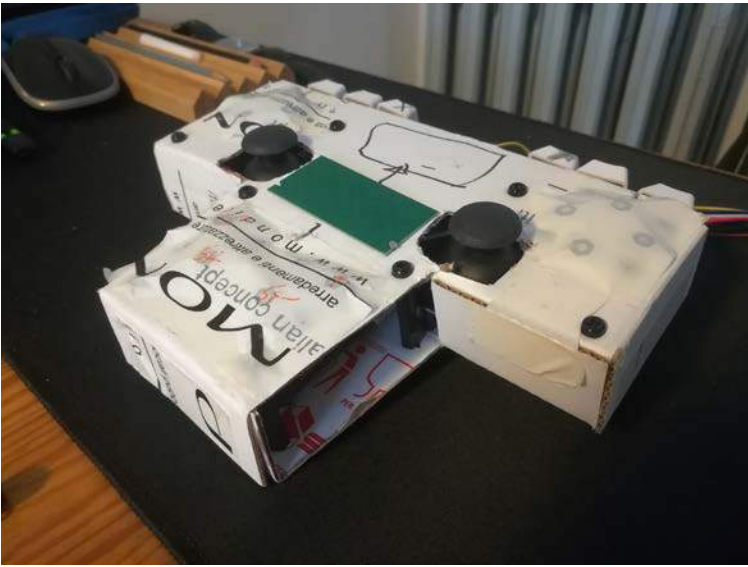


Fig. 3
Gamelon Pad. The first
mock-up used for UX
(User Experience) testing.
Photo, by N. Scalzotto.

and production journey Fig. 4,



Fig. 4
Gamelon Pad. First
prototype with preliminary
buttons layout study.
Photo, by N. Scalzotto.

until the delivery of the fully functional device.
Note that the device is also designed to be adaptable Fig. 5;



Fig. 5
Gamelon Pad. The complete device with “T” and linear shape setup. Photo, by N. Scalzotto.

actually, this is not an innovation by itself, except that, being able to operate with digital fabrication at a personal level, such adaptability is feasible locally in time and at costs that amount to a fraction of what they would be with a traditional approach.

The methodology adopted refers to complex processes and networks of values, particularly referring to the aspects of complexity in which “The interest and awareness in the concept of complex thinking as a competency for educational innovation can be considered one of the causes of the recent increase in publications” (Ramírez-Montoya et al., 2022, p.11).

In this regard, we would like to highlight in particular the most relevant keywords that characterised the present work: creative thinking, complex thinking, health epistemology, systemic thinking (Horn et al., 2022), multi-disciplinary, technology integration, and open design.

The most significant result lies in the increased awareness of the student designer (Hays, 2013), who acquired a greater ability to connect heterogeneous cultural values, developing solid guidelines for a coherent design, and finally adopting and integrating different technological solutions, while practicing and verifying them in the lives of the people targeted by the products/services created.

Conclusions

The Gamelon Pad offered the possibility to test a promising, efficient and effective approach to a multidisciplinary design process starting from the educational experience, since this has been widely identified as the proper place where to introduce innovation to be driven in the future production strategies (Ryan, 1997; Sevaldson, 2013).

In summary, the project offers preliminary evidence of the reasonableness of the starting principle, which sees the learner as a subject involved in complex, interconnected and dynamic processes, but facilitated by advanced and accessible technologies, certainly, but above all by a new way of managing the connections between knowledge, the sharing of skills, the development and production of artefacts and services Fig. 6.



Fig. 6
Gamelon Pad. Fabio using
the final prototype. Photo,
by N. Scalzotto.

What is clear is the radical change in the relationship between objects/people/environment, with obvious advantages for the territorial policies of production, where new principles and practice of Design can regain the values of connection with the human being and the environment that are now considered by many as not questionable.

The project, while approaching certain specific conditions, is to be considered at starting stage; with the appropriate means multiple futures can be envisaged, even not strictly related to the peripheral per se, with the constant technological race of digital manufacturing and the sedimentation of realities more focused on data sharing and production potential: a future full of more accessible peripherals cannot be excluded, not only in the gaming field. The next version for Fabio is currently being assembled, with improvements on weight and usability of the controls. Gamelon Pad will be available on the Hackability portal and major online project sharing sites in the form of instructions and files. Considering how the project is structured we foresee in the future its ascription as a solution focused on economic return or localized, specific small-scale production. Indeed, from the technical point of view, it would be possible to translate Gamelon Pad into a more stable product with just a light adaptation to a more robust, but still flexible digital manufacturing system while possibly expanding it with a set of external buttons and a flight joystick configuration in the near future.

In the didactics of design, especially when deeply connected to research and experimentation, the question that must always be asked is whether the tools provided are capable of withstanding the challenges that will be posed to students, with a perspective, evidently, to doing what is possible to prepare them for the much more complex challenges of the professional market. This approach is therefore to be considered not only didactics, but design itself, considering the perspective whereby the subjects (students) need to satisfy certain fundamental needs (learning experience) while designers (teachers) have the task of providing the solutions. Seen from this point of view, the mode is exquisitely a prerogative of design, which certainly makes design practice one of its fundamental objectives. This approach envisages the identification of solutions that bring about a certain continuity of action over medium to long periods of time, but which in reality, unfortunately, clashes with increasingly rapid, unpredictable innovation processes brought about by a global society that acts globally but affects locally without offering much room for adjustment in the long term. It is therefore a question of devising strategies that are able to look far, geographically and chronologically, but to act close: we can no longer determine our far-reaching choices solely by means of a uniform time scale, as this is either too extensive or too limited. For this reason, in a research field aimed at digital technologies in design, it is necessary to make knowledges transversal, to mix one another and to support subjects so that they share their knowledge, attributing the greatest value not so much to the products of their own ingenuity as to the ingenuity itself. In this sense, the Open-Source approach is promising because it originates precisely from the idea of putting people at the centre, an approach very close to Design but never practised seriously enough to make it unequivocal, inescapable. Certainly, at least in didactics, a subject to put at the centre is already there and it is clear: the student. He/she is the school's cultural target, he/she is young, he/she carries with him the value of the new and of innovation, and he/she will be the next inhabitant of this planet: and if we have not been able to leave it to him/her as he/she deserves, we should at least try to teach him/her not to make our own mistakes while having inhabited the World before.

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You Can Never Solve Problems With the Same Mindset That Created Them. How Can We Change the How and the What We Teach to Enable Our Students to Become Truly “Terrestrial” Designers? A Proposition Following Bruno Latour’s “Terrestrial Manifesto”

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Abstract

We train designers who design effectively for industries and their various target groups. But do we also train designers who can effectively shape the future? We argue that so far, universities have only moderately succeeded in doing so. There are many reasons for this, for the purpose of our paper we are interested in them to a limited extent. We mainly focus on a proposition of variations on how we can remedy this fatal weakness. To this end, we propose three focal points: Strengthening dual access, a stronger focus on materials and cooperation with partners from the industries not only in product-related projects but also in circular processes. Our proposals are a possible translation of Latour’s claim that we as a species must become terrestrial, to survive the climate crisis and its ecological, social, economic, etc. consequences. We will show how this can be done in concrete terms presenting our research project “Exercising change: Transforming Design Education through Circular Practices” in which we research circular didactic and literacy in cooperation with various enterprises.

Keywords

Changing education
Pluriverse education
Responsible knowledge
Collaborative Learning Systems
The role(s) of teachers
and students
Circular literacy

Scarcity of resources, biodiversity loss, energy and climate crises require all social systems to be realigned. As part of a comprehensive transition of production and consumption patterns, the transformation of the economy into a circular economy is called for (Green Deal, 2019). There is still an implementation deficit — also in Switzerland (WWF PWC, 2020). To reduce it, the economy is dependent on practice-oriented and interdisciplinary research. Design is considered a key factor in the transition (Irwin, 2015). This brings into focus the contribution of design education, which is provided at the tertiary level at universities of applied sciences in Switzerland. According to the initial hypothesis, design education is particularly affected by the challenges of transition and the implementation deficit because it provides practical and professional skills.

Design is considered a key factor in the upcoming transformation of society and production systems (Desing et al., 2021). The comprehensive ecological crisis requires minimizing resource consumption by keeping materials and products in a technical cycle for as long as possible or by transferring them to biological cycles at the end of their life (Braungart & McDonough, 2002). The entire life cycle of artefacts and processes must already be considered in the design. In this way, design can influence environmental impacts in a sustainable and regenerative way (Latour et al., 2020) and simplify the implementation of recycling strategies (Desing et al., 2021).

Nonetheless design education does not yet answer in a systematic way to these needs.

We propose reasons as to the why and a possible way how to change this lacuna.

Background 1: Reality and a Knack We Humans Have

Even if it is uncommon for a scientific paper we will start with a story. Although a true one:

Some months ago, a colleague — a renowned designer — and we were sitting outside a café in Lucerne chatting and looking at the “Botox-enhanced” cars i.e. massive SUVs passing by. At a certain point our colleague was fed up with this sight and said: what we need is a design-police to get other cars!

This in a nutshell shows what’s wrong with the concepts so far and why what we really need might be the opposite. These “Botox-enhanced” SUVs do not solve a single problem. Even if they move by E-power. For once because to produce E-cars more grey-energy is needed than by producing other cars (Häntzschel & Stolz, 2021).

So no, that’s not the answer. We don’t need more E-cars, E-bikes. E-scooters etc. But bizarrely enough a lot of producers and designers act as if making everything working on electricity is THE answer. We humans seem to be caught in the sorcerer’s apprentice loop (which is a ballad by Johann Wolfgang von Goethe, but you might know it in its Disney version in Fantasia with Micky Mouse in the role as sorcerer’s apprentice). Like the young person, who discovers how to make technology work for him before technology creates not only difficulties to be maintained for him but for the envi-

ronment, we seem to be able to invent great things, which usually create great problems.

So how do we get out of it? By declaring what's good and admissible design and what is not by a design-police? We don't think so. We suggest that we start by accepting that our securities, our knowledges, and our beliefs are not enough anymore. Which for us academics and designers is a very frustrating state. Because we academics and designers love being right and righteous. We know how things must be done properly, we know what good design is and what isn't, and we know how to make the world a better place.

Do we really, though? We certainly did for the period between the end of Second World War and the seventies. But since then, do we still? We sincerely doubt that! We designers and academics, even though we proclaim and feel different, are just part of the problem as everybody else, because we did not change on a large scale the teaching contents, the goals of higher education, the materials with which we create things. We — as does the sorcerer's apprentice — were trapped in a rather short-termed thinking. Good design is what works for the client and fulfils the needs of the respective target group. We often decided to ignore the externalities design caused and the costs to the world at large — people, climate, plants etc.

Most of us have realised this and are in the process of changing our ways. We would like to add a proposition of how to change what we do in higher education. Design students and design teaching persons find themselves in the identical situation. A situation which is defined by three concepts: The triad of crises that make up the "panorama of modernity": The crisis of recognition, the crisis of self-realisation and the crisis of the political.

The climate crisis as described in Bruno Latour's terms, especially with the concept of critical zones.

And finally, the consequences of the Covid pandemic regarding access to information and the consequences for the ways of how to teach design and train designers.

In each case, we will then examine the consequences for teaching and learning at design and art colleges. Based on this analysis, we will explain our proposal for discussion, for a university teaching that takes its responsibility seriously and really equips students for a "terrestrial" future in multiple uncertainties.

Background 2: All Sorts of Crises Triad of Crises

Andreas Reckwitz (2017) presents a triad of crises that characterise modernity today: The crisis of recognition, which describes the "split between high and low-skilled with the consequence of the polarisation of working relationships and lifestyles". The crisis of self-realisation describes how the failure of the ideal of self-realisation is accompanied by mental illness and burnout. The crisis of the political "refers to the loss of the state's capacity to govern and the fragmentation of the public sphere". Reckwitz sums up in an ideal-typical way the field of tension in which young designers find themselves: they are required to curate their own lives and to contribute to saving the world with their work. The fact that these constellations,

combined with the often-difficult job situation, sometimes result in massive personal states of tension is evident from the fact that for every thirty graduates at our university, an average of one to three fall ill with depression during their studies, after their diploma or during their first two years in the profession, or must take a forced break due to burnout. In our opinion, this is too high a price for our students to pay for taking the contradictory challenges of our times seriously.

Bruno Latour's Contribution

The above-mentioned challenges include that as future designers our students want to contribute to solving the problems in the world. The concept of the "critical zone" as used by Bruno Latour makes an important contribution to understanding these problems. The concept of the critical zone originated in the natural sciences and refers to the relatively thin layer of the atmosphere, biosphere and hydrosphere shared by all life forms. Humans do not stand outside the critical zones but are part of this environment of diverse dynamic processes. Which is why we must deal with ourselves and all living beings and elements of the three spheres in a completely different way. Latour suggests that we must become "terrestrial" to be able to do this. By this he describes that in the global North we must, on the one hand, consider the fact that the place where we live is usually not the same as the places from which we draw our wealth. On the other hand, it means that design must also contribute to "regenerative measures". Circular materials, products and services can contribute to this. But more is needed. And our students must be able to do both — circularity and more, which we do not know yet. This means that we must develop and offer other teaching contents and teaching formats.

The Consequences of the Covid-Pandemic

The pandemic has equipped us well for this in that we have prepared relevant information for our teaching within a very short time so that it is widely accessible. But information is only the raw material for knowledge. For this raw material to become sustainable knowledge, it needs active discussion and systematic reflection, i.e., experience. In other words, teaching-situations that become a space of possibility for exchange and experience and thus stimulate, moderate, and promote the creation of real knowledge in the students.

Our Proposition: Learning Together = Another Way of Teaching

Separation of Information and Knowledge Acquisition

During the pandemic, many of us — including ourselves — made the teaching content available to our students in digital formats (mp4 and the like). Students were able to access this content regardless of time and place. We propose that this principle be maintained. As well as the practice of students to consult online-formats, of designers, other university lecturers, blogs, podcasts etc. as sources of information.

We suggest that we stick to this form of information search: By handing over the responsibility of information acquisition to the students, firstly, an initial acquisition already takes place and secondly, teaching time is freed up for experiences with this knowledge and thus for the effective acquisition of knowledge. In the process, we change our roles and tasks: On the one hand, we are no longer the holders of specific, and as it were “correct” knowledge, but we offer a variant of knowledge. On the other hand, it is of eminent importance that we consider the embedding in the “critical zone” when presenting the “briefing” (topic, task, etc. of the respective teaching format). We thus create the framework for the students to ask questions to the information search.

Checking, Linking, and Testing Information (Incl. Materials)

Students must be able to filter out the valid information from the mass of information. To do this, they must critically examine the information, they must link the information with each other, with their own observations, with previous knowledge, to be able to draw an overall picture. We mean the latter literally: the linking of the information must also be done by hand. And finally, they must try out the information, test it e.g., with role plays, with scenarios that they develop and act out, etc.

In this step, the role of the lecturer is that of a sounding board and mentor: we ask critical questions, encourage a change of perspective, offer variants for test methods, discover other possible links with the students if necessary.

Exploration of Materials

The material is one of the key elements in design. Often students start with the intentions of using circular or at least sustainable materials. Usually their intentions meet with difficulties (nor really circular material or the circular material is way too expensive or the just don't know) or the decide along aesthetical reasons which seem to exclude the sustainability aspect. Therefore, we must chance the access, the thinking about and the use of materials. This might mean for the design process and thus for the design teaching, that material and product development cannot be treated as two different disciplines anymore. And this means that we teachers and professors are as much explorers as our students.

Giving Absolute Priority to the Circularity of Materials, Processes, and Products

But when designing under the conditions of the circular material — and production — processes what does this mean for the teaching of design? By what methods will we train such designers? On which competencies do we have to focus or which competencies to we must train in and with our students to enable them to be terrestrial designers?

We assume that one of the keys for becoming terrestrial lies in the so-called transversal competencies: These are all skills that people may or may not have and which are relevant to jobs and employability. Ecological action is a transversal competence. But the focus on circularity means also, that we must look for partners in the industries. The exploration of materials must go hand in hand with partners from the production-side.

We use the above mentioned four parameters as framework for the iterative processes in our research project *Exercising change: Transforming Design Education through Circular Practices*: as mentioned above Design is considered a key factor in the upcoming transformation of society and production. So if the entire life cycle of artefacts and processes is already considered in the design, design can reduce environmental impacts and simplify the implementation of circular strategies. The necessary design methodologies have been differentiated since the 1990s. Despite these methodological efforts, there is an implementation deficit. This presents design education with the challenge of training future designers and decision-makers for a professional field that is also in the midst of this transformation. This observation as well as the above described four parameters form the basis of our research project that examines the requirements for a design education that is open to the future.

The necessary transition to a terrestrial way of teaching, learning, producing, and living changes the historically grown relationship between design education and practice, which in Switzerland was legally established with the Bologna reform. We suggest to part with those ways and that instances/actors must simultaneously acquire the necessary knowledge and practices in this phase characterized by uncertainty and not knowing how. Requirements for the initial competencies of design students are currently shaped more by an ideal image of sustainability than by concrete, proven practice. This raises research questions that relate to three thematic areas (vocational design education as part of ESD, (Education for Sustainable Development UNESCO 2020); circular economy and design; transformation as a process):

- How do successfully educate design students and future decision-makers in and for transformation?
- Which settings are suitable for all stakeholders to teach and sustain circular practices and processes?
- What skills must be taught as a matter of priority so that all participants can recognize and analyze the structure of “wicked problems” (Rittel & Webber, 1973) typical of environmental problems and integrate them into the design process?
- How can companies act in a sustainable circular manner if the overall economy does not yet follow this model?

- How to teach craft, in a process that is not written down and often is based on implicit knowledge which derives from working (in the largest possible sense) with materials.

One of the objectives of the project is how to deal with all the uncertainties that arise out of the multiple crises situations and out of the fact, that we need to design, think and act in a new way (certainly a circular way but maybe not only) but nobody really knows how circular in every way is really realizable. For instance, never generating more waste means being able to recycle the resources used after the death of an object, to be reintroduced into the cycle. This means that every single element on an object must be developed in such a way that it serves the cause for further life in a new cycle (Second Life, Third Life). Material knowledge is treated as one of the forward-thinking arguments in Circular Thinking and can already act with concrete circular products in the material cycles today. The role of design and aesthetic sensations in the design processes is unclear. Today's educators lack practice fields to develop teaching methods and practices for circular processes and to be able to teach them in a prototype-like manner in a first step. To test these directly and clarify their effect on sustainable circular teaching.

The interdisciplinary, applied research project *Excercising Change* uses the example of design education to investigate the conditions for success of joint learning between education and practice in transition. On the one hand, the project offers companies security in that they can use the accompanying uncertainty innovatively and creatively. On the other hand, the universities of applied sciences gain an innovative and effective set of methods for equipping students and decision-makers to deal with uncertainties in a sustainable way and to meet the challenges of circularity.

We clarify how design contributes to transition and with which set of methods this can be anchored in design teaching.

The research project is organized around a series of workshops (1-2 parallel, duration one semester): in these workshops interdisciplinary teams of students as well as lecturers will work in cooperation with enterprises on practical and concrete cases to explore methodological approaches to circular design with the objectives of finding effective variations of answers to the needs of circular design and economy as mentioned above. The results of the research project should be validated statements on 1) whether and how design education can successfully in an open process collaboratively convey circularity and thus offer an education that is open to the future; 2) how "professional competence" can be defined in the transition as a target of education at the level of Universities of Applied Sciences and Art. 3) whether and how companies in transition can operate sustainably in a circular way, even if the main economy does not yet follow this model.

The results of the research project have a 1) didactic effect on design education, which can use innovative and effective method sets to equip students and decision-makers: 2) in terms of educational policy, on the establishment of circular processes in the four-fold performance mandate of universities of applied sciences as well as the redefinition of professional competence. 3) methodologically: on specific product development processes of the participating practice partners and allow statements on the methodology of circular product development processes.

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Good for Good. Designing Packaging in the Era of Deliveries

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Abstract

Packaging is one of the classical field for the design activities where both functional, technological and communication features are faced. Design has considered packaging as a field where mainly experiment and develop the consumption engagement and attraction. In fact, the most part of the Design effort has been focused on new shapes, new aesthetics values, new uses: in sum on the product innovation. This paper reports a didactic experience where packaging has been using to training a “systemic planet-centric” approach, merging the following aspects:

- from social point of view, the phenomenon of self-production and consciousness consumption;
- from technological point of view, the improvement of new manufacturing;
- from economic point of view, the phenomenon of open-sourcing and the sharing-economy;
- from environmental point of view, the phenomenon of the zero-impact, zero-waste and zero-resources.

Keywords

Packaging design
Environmental design
Systemic design
Era of deliveries

The Era of Deliveries

Containment is a very ancient human need. Starting from the Neolithic period (10,000 BC), man began to combine hunting and food gathering activities with the development of agriculture. Agriculture required artifacts for protection, food preservation, movement, and later, in support of mercantile activities. Many of these artifacts, often made with artisanal techniques and with local materials, have remained unchanged for many centuries. We also know how, in the second half of the nineteenth century, due to the effect of the Industrial Revolution, the modern packaging born, immediately becoming also a driver for market promotion thanks to its fundamental role in making possible increasingly large productions and increasingly distant transportations. The real radical evolution of packaging dates back to the second postwar period and in particular to the 50s, when the massive use of polymers and cardboard-based products began to spread for disposable packaging and, starting from Europe and the USA, when mass production, distribution and consumption models were introduced (supermarkets, malls, self-service sales, global markets, correspondence selling, and, today, e-commerce).

Traditionally, packaging design has had a subordinate role with respect to product design and production systems design; however, its impact on supply chain costs and performances can be devastating. Only in the past few years its strategic role has been recognized both in theory and in practice (Azzi et al., 2012). Nowadays, the critical impact of the packaging from economic and environmental point of view, is recognized both from companies, who need to reduce the environmental cost — also for the use of energy and resources — and from governments and civil societies who pays the negative effects, in particular for the management of the waste stream that the disposable packaging system generates (Barbero & Pereno, 2020). It is possible to state that packaging industry has become one of the most crucial sectors in the value chain as well as the flow of goods is strongly characterizing our contemporary society. In fact, the exponential growth of the e-purchases — also due the pandemic constraints — has put “distribution” on the top of the priority of any business. As consequences, packaging is become an important part of the product and service value, both from the economic, environmental, productive and also cultural point of view. In this scenario, Design for packaging has to completely reframe its goals, using a systemic approach and a sustainable perspective facing the entire production, distribution, consumption and dismissing process. The urgent to act towards a different solution, has dramatically grow during worldwide COVID-19 pandemic when an important percentage of the population, in different part of the world, turning a lot of life activities in online mode with a strong effect on transportations patterns (Beck & Hensher, 2020; De Vos, 2020; Grida et al., 2020; Loske, 2020; Mogaji, 2020). Specifically, the pandemic has had a significant impact on the way we shop, with a clear movement towards e-commerce. Just to mention few examples, Instacart, a popular grocery delivery service in the United States, experienced a 500% growth in April 2020 (Petrova, 2020). May 2020 saw a 78% increase in online shopping compared to May 2019 (Samet, 2020). With the pandemic shifting sales online and consumers flush with

stimulus checks, Amazon in April 2021 reported \$108.5 billion in sales in the first three months of the year. It also posted \$8.1 billion in profit, an increase of 220% from the same period in the previous year. The high volume of orders during the pandemic has let Amazon operate more efficiently. It has run its warehouses closer to full capacity, and delivery drivers have made more stops on their routes, with less time driving between customers. The number of items Amazon sold grew 44%, but the cost to fulfil those orders was up only 31% (Weise, 2021). After a such extraordinary global event, it is particularly clear that the e-commerce explosion has today significant implications for the worldwide distribution sector and its footprint on environment (Figliozzi, 2020).

Context and Methods of Experimentation

Although, packaging as design topic for a didactic activity is not a new issue, taking in consideration the new scenario, it has been decided to choose it for the Advanced Design Studio led by the authors, provided in the a.y. 2020-2021 at the Master level. A class of around sixty students, from more than ten different countries in the world, working in a blended mode, has been involved in a design activity focus on the new future of packaging in the “era of deliveries”.

Methodologically, a hybrid design approach has been proposed merging different tools, each of them related to one emerging cultural and technological phenomenon (Rawsthorn, 2014; Thackara, 2015; Gold, 2007):

- using tools of future studies, the phenomenon of self-production and consciousness consumption has been faced touching in particular the social aspects;
- using tools of service design, the phenomenon of digital and open manufacturing has been faced touching particular the technological aspects;
- using tools of design for social innovation, the phenomenon of open-sourcing and the sharing-economy has been faced touching the organizational aspects (Thackara, 2015);
- using tools of design for sustainability, the phenomenon of the zero-impact, zero-waste and zero-resources has been faced touching the environmental impact.

The students, working in teams, have developed a three-steps design paths where: the first has been focused to recognize the “room to act”; the second has been focused to propose a possible innovation; the third one has been focused on the validation of the design proposal reframing the entire supply-chain and testing a prototype in a real contest considering also the local impact.

Finally, the several design proposals, grouped according to the sectors of consumption to which it is intended — food delivery and distribution, medical products, plants and fresh products, clothes — have been compared and related, each with the other, to simulate the impact in the whole packaging system. Due the pandemic constrains the didactic activities have been developed in blended mode and each team involved students who worked in different part of the world and therefore with a different “social environment” where they had to face the proposed innovation.



Fig. 1

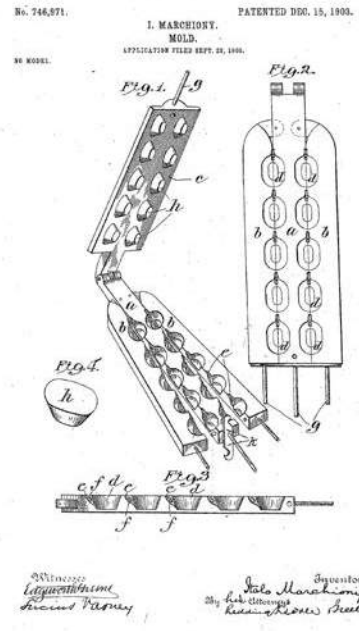


Fig. 2



Fig. 3

Fig. 1
Italo Marchiony, Ice Cream Cone, an example of edible packaging, Ben & Jerry's Homemade Inc., 1896. Source: MoMA.

Fig. 2
Italo Marchiony (Marchioni), Moulding apparatuses used in the manufacture of ice cream cups - United States Patent Office patent n°746971, December 15, 1903. Source: United States Patent and Trademark Office.

Fig. 3
Fortunato Depero, Campari Soda, an example of naked packaging, Davide Campari-Milano, 1932.

Fig. 4
Alessandro Stabile and
Martinelli Venezia, Chair
1:1. An example of flat
packaging, concept, 2020.

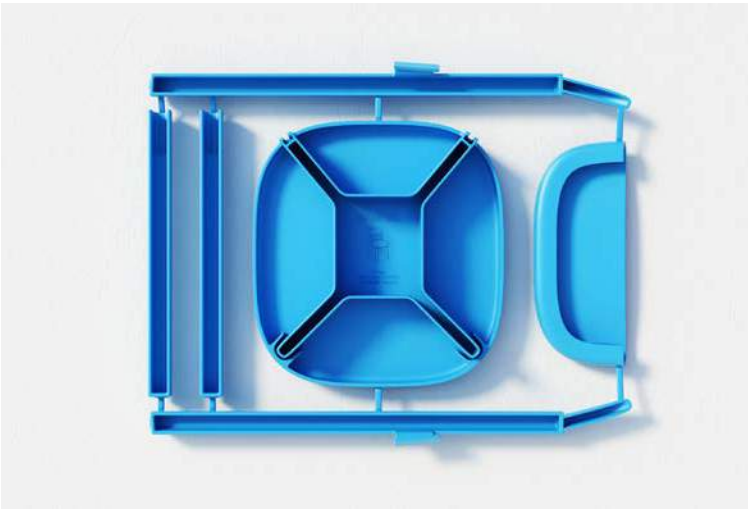


Fig. 4a



Fig. 4b



Fig. 4c

From the didactic perspective, the engagement and the effort of the students, despite the blended mode of interaction, has been positive. Each design proposal has been prototyped and tested within a real context and the students had the possibility to improve the capability to independently involve a wider network of stakeholder than the one typically encountered in the academic context. In this way they lived the design experience with more involvement, despite the physical distance. From the culture perspective, the design critical skill improved facing with a wider question rather the typical product-centred or people centred approaches (Di Lucchio & Giambattista, 2017). In fact, the future of packaging, which has been verified from different features, may be reasonably considered one of the issues towards which a planet-centred design must focus on.

Discussion and Open Themes

The first clear observation concerning contemporary packaging is that the global ecological footprint of disposable items is a fundamental problem. In a nutshell, we can say that nowadays we have gone from consumption models that encouraged refilling (returnable empty containers) to models that favor single use (disposable) packaging (since it became increasingly cheaper and lighter). One of the major criticalities of modern plastic packaging lies in the very nature of plastic which is a material characterized by strong resistance and durability, but this characteristic is not consistent with pack solutions which foresee limited use over time. This is no more a sustainable behaviour, overall if we use oil-based plastics that are long-life materials to manufacture packaging parts. We are obliged to reduce the quantities of packaging and of eco-critical materials, to re-think the lifecycles of packaging, working on reusability and enhancing, as final chance, recycling. So what should we do as designer? Of course we need to deepen all the systemic aspects concerning packaging and all the chains of goods. A good idea for example should be to use organic materials (fibers, leaves, peels), and processing natural and local materials as less as possible. This strategy can overall be suitable if we adopt organic scraps of other productions (agriculture for example) or at least if we use fast-growing organic materials which require few use of water. When it is not possible to use organic materials as we find in nature, we could use them to develop biodegradable materials as organic pulps and bio-plastics made of corn, cereals, different kind of organic starches and fibers. Here the main issues affect the economic sustainability, so the containment of production costs. It would also be necessary to regulate the origin and characteristics of the raw materials we use, to avoid going to affect even more the phenomenon of deforestation. Furthermore, considering the rather high transport costs of biomasses (as in general they are voluminous and heavy when they are rich of water), local procurement should be favoured to reduce the transports impact. A more advanced field of research affects the possibility to use edible materials for food short distance packagings, so in order to use the packaging itself as food for humans or animals and so to shorten as much as possible the lifecycle of the packaging and never let it be an eco-critical debris. Another possible way to innovate in packaging

material design regards the choice to use only one material, and to avoid as much as possible printed labels or varnishings or printing processes that have a strong environmental impact.

From the didactic experimentations we made, it is possible to identify an alternative strategy to returnable/refilling packaging. A good design opportunity could also be to provide for single-use packaging a long-lasting “second life”. A good historical example are the flour sacks that were in use in US during the great economic depression of 1940s. At that time the sacks to deliver flour were made in white natural cotton. The motto of the Depression Era was “making do” while making sure nothing was wasted and everything was re-used or recycled. This sparked families, and women in particular, to get incredibly creative with how they handled meals, goods, and rationed water and utilities. Almost every woman had the sufficient skills to sew and to make dresses and they began to use cotton flour sacks to make them. This trend quickly caught on, it became a sort of fashion trend and so a cultural value of this specific period, and so the flour companies supported this behavior by beginning to print colored patterns on their bags, also investing in strong advertising campaigns and they also printed instruction leaflets to give to the women methods, sewing models and suggestion to tailor clothes parts and dresses, but also dolls for children, tablecloths, towels, pillows, kitchen aprons, and so on. This design approach could be repurposed today or in the near future.

Another important technical aspect concerning the general functionality and the sustainability of shipped goods is about the volume saving. A flat box is cheaper to deliver, it has a generally lighter footprint and it is easier to manage during all the lifecycle (also during the recycling phases). With growing concerns about freight transport emissions, so it has become imperative to find ways to reduce package dimensions or to improve packaging fill rate that increases vehicle utilisation efficiency (Ahmad et al., 2022). So the purpose of new design efforts in this direction is to identify and evaluate interventions aimed to improve space utilisation at various levels of packaging in freight transport operations.

Conclusions

As described in the introduction, the methodological objective of this didactic-design experimentation was aimed at understanding the results of a shift of attention from the product/service innovation, that is strictly linked to technological, morphological and usable aspects, to the process innovation, that brings into play the systems/contexts in which the production and consumption cycle is determined.

This shift of attention from product innovation to process innovation is the result of a progressive loss of centrality of product design, in particular in the design research, in favour of the complexity in which the products are involved both in the production, consumption and disposable phase.

Due to a deep change of scenario, in recent decades Design as a discipline and practice, feeding itself more and more on multi-disciplinary contaminations, has shifted its attention from the morphological and technological aspects of an object (both material or



Fig. 5

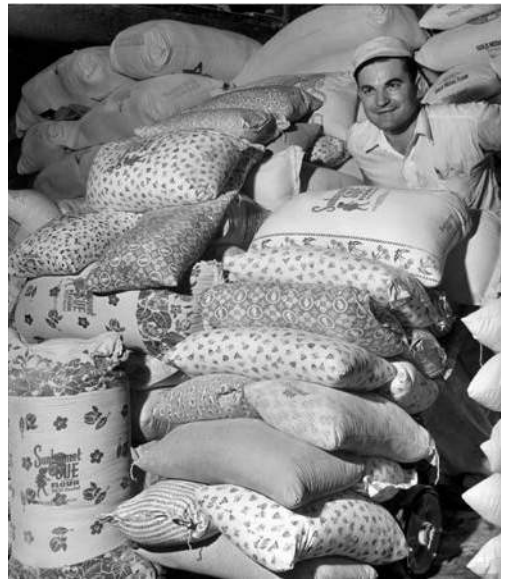


Fig. 6

Fig. 5
Yod Corporation, Loong Glin Orchard. An example of organic packaging, GI Agricultural Products, 2012.

Fig. 6
Flour sack with decorative patterns. An example of reusable packaging, USA, 1940s.

Fig. 7
John Habraken, WOBO bottle. An example of reusable packaging, Glasfabriek Leerdam for Heineken, 1963.



Fig. 7

immaterial) to questions related to the interaction in between object and man (Human-Centred Design), in between object and environment (Design for Sustainability), in between object and object (Design for Interaction), in between object and society (Design for Social Innovation), to arrive to completely exclude the object from the innovation process (Design of Services).

From a methodological point of view, this expansion of the factors has determinate what we can consider the updated version of process innovation which is namely recognized as Systemic Design (Peruccio et al., 2019). A design practice focused on complexity and plurality where the design result is a direct consequence of open flows of exchanges and knowledge and where time is the key that determines, increases, reconfigures the project itself or at least its capacity for innovation.

Systemic Design provides tools to understand and apply a complex vision to the design process, by recognizing that: the outputs of one process must be considered as potential inputs for another process, in an open system capable of self-generation; that relations are the constituent elements of the system and not just a result of it; that according to a biological metaphor systems are such if they respond to the principle of “autopoiesis” and therefore that any intervention on the system cannot and must not be contrary to it; that the system is contextual and situated and therefore not abstract and even the singular user is part of the system her/his is no longer at the centre of it.

Based on these methodological premises, didactically the risks of an experimentation based precisely on Systemic Design can be connected to the impossibility to evaluate the validity of innovation over the simple meta-design stage.

It has been widely described how packaging, taken as a field of didactic investigation and experimentation, allowed to address all the aspects of complexity on which Systemic Design focuses.

At the end of the experimentation carried out, however, an attempt was made to qualitatively measure whether and how the students were able to evaluate the validity of the innovation.

The answer was positively found when the physical dimension of the design activity (in this case the packaging) has been used to measure the systemic dimension. In fact, if the design of a material product offers the possibility of testing it at least in use and disposal and simulating its production and eventual recycling, in the case of packaging, that is strongly connected with another object (the one it contains) and with different processes (production, distribution, storage, consumption), the complex system of relations it determines can help to equally validated the system.

With this purpose, the didactic experimentation has involved 3 levels of prototyping useful for validating the level of innovation proposed. A “dirty prototyping” phase has allowed students to focus on the usability, sustainability and technological smartness aspects of the object. A “rapid prototyping” phase has allowed to identify the more suitable production processes. A last phase of “service prototyping”, during which the previously prototyped packaging has been used in a real context by various process stakeholders, has allowed students to measure the degree of systemic innovation. Exactly this last prototyping phase, with a higher degree of failure than the previous ones, was the most didactically decisive with respect to the objective to develop the

student's capability to evaluate the Systemic Innovation and therefore to positively apply a Systemic Design approach.

Certainly, in the practice of Systemic Design, and therefore of process innovation, the question of how to teach and therefore evaluate the time factor remains open. But from the experience made, it emerged the need not to exclude in the didactic context of Design Systems the role of the physical artefacts as valid tools to measure the process innovation.

Of course, in order to have more valuable conclusions, this experience has to be replicated and for this reason also a specific critical evaluation grid has been developed to compare the here obtained results with the ones from other and new didactic experiences facing the same topic from a systemic-perspective.

A packaging decision is a complex process involving different actors to consider, many functions to serve, different requirements to satisfy and conditions to pay attention to. Hence, a packaging decision requires a holistic approach that provides means to manage these complexities (Hellström & Saghir, 2007).

Design culture, if it really will understand this condition of complexity of future challenges connected to packaging, has the strategic role to provide answers to continuously growing demand of innovation: main drivers of these trends are certainly globalization and increasing distances between point of production and point of consumption, environmental crisis, changes in social behaviours, demographics and lifestyles, improvements in hygiene standards, adoption of new materials, development of new distribution services.

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Onboarding Future Systemic Innovation Designers Through Informal and Collaborative Activities

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Abstract

The contribution presents a collective learning system developed by the Innovation Design Lab team within the Innovation Module of the Master's Degree in Systemic Design of the Politecnico di Torino.

A strategy aimed at the development of all those soft skills useful to bring out the potential of the individual's contribution in projects of entrepreneurial, innovative, and sustainable impact.

The research shows the results of educational methodology that integrates digital ecosystems and collaborative tools, highlighting how, from the students' visions, emerges the urgency to design new future-oriented teaching-learning practices.

Keywords

Education

Systemic innovation design

Team building

Soft skills

Tools

Introduction

Technology is an agent of change within education, potentially transforming traditional modes of teaching and learning (Selwyn, 2019). Faced with new or unforeseen scenarios, experiences, skills, and methods, it seems outdated. If sudden changes in contemporary society have made — in the recent past — the educational system partly obsolete, the impact of the pandemic has been disrupting, making a complete redefinition of the educative act as urgent as ever. In other words, digital learning has been a logical approach worldwide to facilitate adaptation to a new normal and enhance educational quality (Humayun, 2020). What future lies ahead and what role remote teaching will assume — synchronous, asynchronous, or blended — is still difficult to predict today. However, the real challenge will be to treasure the experience of this period and to think about what elements of the formation of the future will be able to find in the digital system an effective and efficient tool for the personal enrichment of everyone.

The opportunity to apply an educational methodology that integrates digital ecosystems and telepresence equipment is increasingly attractive, with countless applications and possibilities to engage students in blended contexts. Digital learning created promising opportunities for educational institutions; however, there were challenges relating to technology, courses, instructors and learners (Händel et al., 2020; Shehzadi et al., 2020). The problems of implementing applications on teachers' and students' devices, limitations of technology platforms, quality of the internet, learner-teacher interaction, and limited training of teachers and learners regarding the online learning system influenced the effectiveness of learning in a digital environment (Dinh & Nguyen, 2020). In addition, the ability to adapt to immediate changes in a new situation would affect the future of online learning.

The contribution presents a collective learning system developed by the Innovation Design Lab team as part of the Innovation Module in the MSc degree program in Systemic Design at the Polytechnic of Turin. This strategy focuses on replicating and adapting teaching methods in a blended format to reinforce transversal skills crucial for fostering individual contributions in projects with entrepreneurial, innovative, and sustainable impacts.

Theoretical Framework

The design of a learning pathway is based on the knowledge that a class of students forms a community that generates a flow of ideas (Pentland, 2015). Collaboration between students during community building, team building and group work stimulates the exchange of skills and backgrounds, fostering collaborative and idea-generating processes. The educator plays a crucial role in designing collective learning experiences, using methodological and pedagogical tools to facilitate the circulation of ideas and guide innovative and design processes within student teams. Visual design, when used effectively, improves accessibility, stimulates interest and involvement and helps students make connections between ideas (Lohr, 2008, p. 15). The

pandemic-induced shift to virtual learning necessitated a re-evaluation of learning experience design. The use of visual languages and communicative processes, mediated by interfaces and human-device feedback, is crucial for effective learning event design. Graphic design principles make information more accessible and engaging (Lohr, 2008, p. 7).

Designing practical learning experiences in a digital environment requires strategies and content that support step-by-step learning events and provide clear rules and instructions to reduce confusion. Confusion can lead to frustration and negatively affect the educational value and overall perception of the learning experience (D'Mello & Graesser, 2012). For this reason, visual design and modular design techniques are employed to create digital content that aligns with the graphic and systemic design world, incorporating analogue and digital technologies and expressive languages. Research on text segmentation, spacing, typographic signals and semantic visualisations inform the educational basis for designing ways to help students understand text (Hartley, 1985; Mayer, 1984; Park & Hannafin, 1993). Distance education emphasises interactions between different parties and through various channels to enhance students' involvement in the learning process (Moore, 1989; Riggs, 2020).

The hypothesis is that integrating collaborative learning methodologies, visual design principles, and the effective use of digital tools within educational settings offers valuable opportunities for innovative and engaging learning experiences. This approach enables the development of essential skills, promotes an entrepreneurial mindset and prepares students to navigate the complexities of a rapidly changing world.

Educational Context

In the context of the Master's Degree Programme in Systemic Design, the focus is on developing designers who can collaborate effectively across disciplines and drive innovation in key areas (Gaiardo et al., 2022). Integrating the Systemic Innovation Design Methodology (SIDM) into the module promotes core competencies such as creativity, flexibility, adaptability and entrepreneurship (Gaiardo et al., 2022). The course explores productive, social and economic innovation with a multidisciplinary approach, particularly in food-related changes within a particular territory (Gaiardo et al., 2022).

In line with the educational scenario, the Innovation Design course embraces the learning by design method, a design-based approach that integrates design principles and practices into the educational process (Papert, 1991; Kolodner et al., 2003). The course aims to create a dynamic and interactive learning environment by immersing students in authentic design experiences and applying the Systemic Innovation Design methodology. This approach nurtures creativity, critical thinking and problem-solving skills (Gaiardo et al., 2022; Kolodner et al., 2003).

The collective learning system developed by the Innovation Design Lab team exemplifies the integration of learning-by-design methodologies within the Master's programme (Gaiardo et al., 2022).

By incorporating the principles of visual design and modular design, the educational experience becomes more engaging and accessible to students, enabling them to tackle complex design challenges and apply their knowledge in practical contexts (Lohr, 2008; Gu et al., 1997). Through collaborative projects and hands-on activities, students develop a deep understanding of design concepts and acquire the skills and mindset necessary for entrepreneurial, innovative and sustainable projects (Gaiardo et al., 2022). Promoting creativity, critical thinking and problem-solving skills, this approach provides students with the skills they need to succeed in a rapidly changing educational landscape (Kolodner et al., 2003). The integration of new digital tools and teaching methods in learning by design allows educators to adapt and provide students with up-to-date learning experiences to new design possibilities and the diverse needs of new generations of learners.

Methodology Description

Designing Learning in a digital environment

The model described expresses different pedagogical approaches to enhance transversal competencies mediated by digital tools: telepresence, simultaneous collaboration, and synchronous and asynchronous communication. In the education sector, large classes remain a popular method of instruction worldwide because of their cost efficiency (Yardi, 2008). An advantage of digital technologies is that they are highly scalable, can be improved from the assets already in place, or refer to a more extensive range of participants without additional investment and materials. In contrast, physical assets need to be rearranged and renewed according to the management and spatial requirements of the class each time they are held.

A collective learning system to enhance educational blended paths

To address the pandemic changes, the contribution presents a study on a teaching-learning model by developing a series of complementary activities to the course. The organizational process has also focused on some digital tools capable of amplifying collaborative and productive processes without ever losing that part of physical interaction.

The activities aspired to provide participants with opportunities for informal learning and to contaminate the course's critical concepts by integrating some soft skills of the methodology used (Gaiardo & Tamborrini, 2015) and, more generally, of the study's objective. In this way, it has been possible to relate the development of those skills to specific notions, together with the methods that are part of the methodological approach.

Sixty students represent the classroom sample, many attending the first year of the MSc degree. Each one of the planned activities was submitted during specific phases of the course Fig. 1. The aim was to stimulate the community's processes and prepare students for the subsequent phases of the development of the final project.

Summing up, activities 1, 2, 3, and 4 focused on enhancing individual and collective awareness of innovation's concept, which defined the class background. Activity 5, the Food Design Lab, aimed to expand participants' knowledge and critical thinking through a participatory and collective process, recreating learning conditions by doing and incorporating physical and analogue design processes to observe their emotional and cognitive impact.

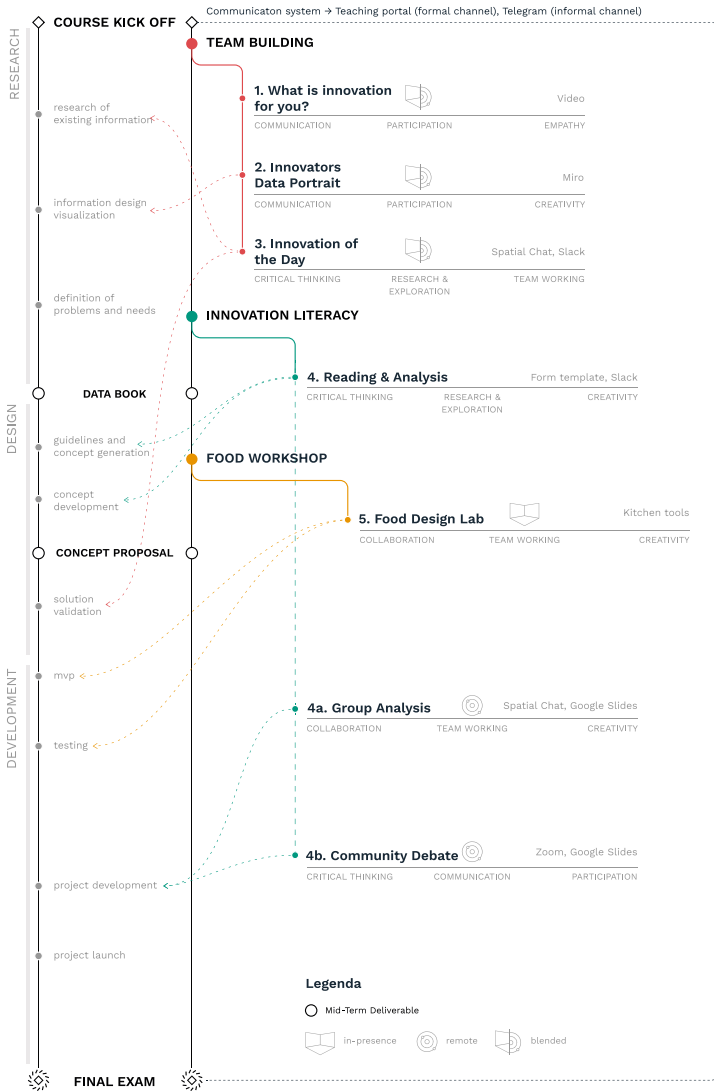


Fig. 1
Sofia Cretaio. *Learning path and activities.* Collective learning system to support the Systemic Innovation Design Methodology. Ph. Innovation Design Lab, 2021.

Knowing the context of action is the first step to developing innovative and sustainable outputs. The same principle is applicable in the construction of relationships within a university course: therefore, the first step was to get to know the students, asking them to answer, through a short video, the question “What is innovation for you?”. By limiting the criteria for the realization to a minimum, students were free to narrate their idea avoiding the embarrassment of public speaking.

The question was then deepened in a second ice-breaker activity that introduced one of the first approaches of the SIDM: information visualization. Inspired by Giorgia Lupi's Data Portrait project, students were asked to portray their innovation idea using square and replicable elements. The activity, although individual, was carried out through a collaborative board on Miro Fig. 2, a meeting point between students in the presence and remotely.

The result is a visual curriculum in which the translation of personal information into data has generated a synthetic and inclusive language (de Freitas et al., 2021) of their course expectations.

Once the concept of innovation was defined, a more practical application of the topic was developed by proposing a series of Innovation of the Day research for cases study.

The activity required the random arrangement of groups and introduced to the students the second step of the SIDM: the search for qualitative resources to support the design-phase analysis. In this scenario, the involvement of students took place in a virtual space: Spatial Chat, a platform that allows — through avatars — to move in a digital environment like in a physical one.

Later, students were introduced to the design and development phases through a practical workshop focused on food matter. The theme “Visual Power of Food Surplus” allowed the participants to deepen the topic of food waste from a design perspective.

The students, organized in mixed groups, had to work with surplus products, overturning their semantic and aesthetic characteristics and applying the steps of the SIDM: from the concept ideation to the development and prototyping Fig. 3.

Later in the semester, the focus was moved toward students' ability to develop critical thinking. The activity of Innovation Literacy has required them to read a book that addresses the topic from different perspectives — food, data, society — and then outline a critical analysis.

The activity took place in asynchronous and synchronous moments, combining individual steps with moments of teamwork; the students, now accustomed to working with selected teammates, had to reorganize into temporary groups depending on the book read to complete in a limited time, an overall review Fig. 4. The result of the meeting was poured into a set of shared slides that were then discussed collectively through questions that challenged the thoughts of individual students and the design solutions now being developed Fig. 5.

Furthermore, as part of this activity, students could express their understanding and interpretation of the books by creating customised book covers. These graphic interpretations allowed students to explore the books' themes further and express their ideas visually, thus enriching their learning experience and contributing to the collective discussion.

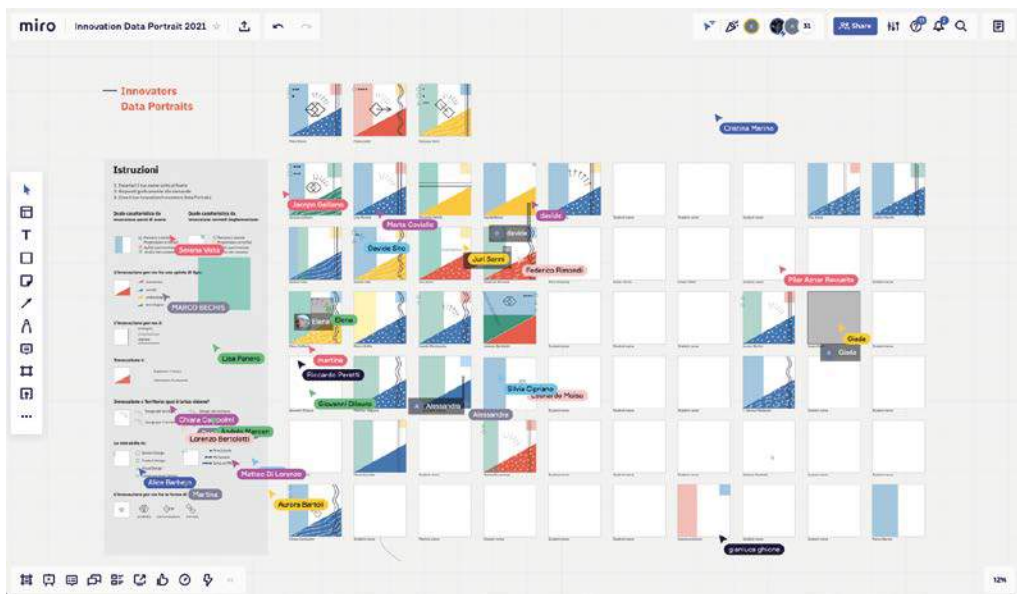


Fig. 2
Chiara Remondino. *Data Portrait Activity*. Simultaneous creation of data visualization using a Miro Board. Ph. Innovation Design Lab, 2021.



Fig. 3
Leonardo Moiso. *Food Design Lab Workshop*. A design team experiments with shapes, food and kitchen tools. Ph. Innovation Design Lab, 2021.

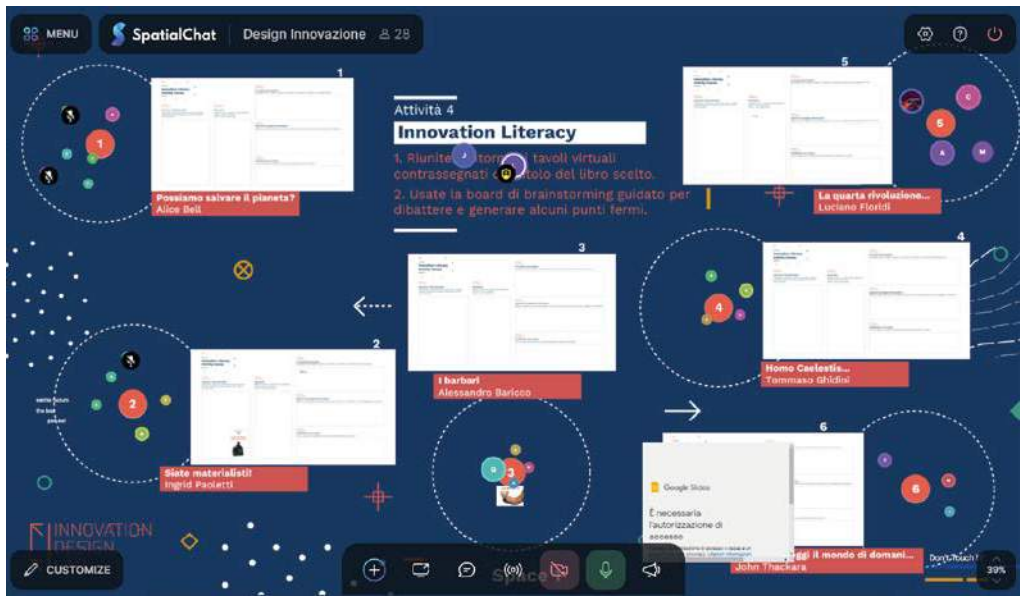


Fig. 4
Leonardo Moiso. *Innovation Literacy Activity*. Working in groups using Spatial Chat. Ph. Innovation Design Lab, 2021.



Fig. 5
Sofia Cretaio. *Innovation Literacy: community debate*. Students presenting their alternative covers to the original book. Ph. Innovation Design Lab, 2021.

The activities described align with the components and learning objectives of the Innovation course. This course aims to cultivate a multidisciplinary understanding of innovation and its impact on technical, productive, social and economic aspects. The multidisciplinary laboratory is an essential component of the course, which serves as a platform for integrating input from different disciplines. The activities described in the article, such as developing soft skills, integrating collaborative digital tools and applying the Systemic Innovation Design Methodology (SIDM), directly contribute to achieving the course's learning objectives Fig. 6. The activities also emphasise the importance of combining analytical skills with design thinking.

- The first activity focuses on community and team building, creating a sense of belonging among students and fostering practical teamwork skills.
- The Data Portrait Project engages students in visualising and representing information through creative and meaningful data portraits describing themselves and their skills.
- Innovation of the Day Research encourages students to explore qualitative resources and conduct research to support their design analysis.
- The Food Design Workshop combines analytical skills in reading the territory and social issues with hands-on design thinking. Students work with surplus food products, applying the Systemic Innovation Design Methodology to generate innovative design solutions that address the issue of food waste.
- The Innovation Literacy Activity strengthens critical thinking skills by giving students diverse perspectives to analyse and discuss. Through reading and asynchronous and synchronous discussions, students challenge their thoughts, contribute to design solutions, and expand their understanding of innovation from different angles.

The activities integrated into the course aim to stimulate active learning and interdisciplinary collaboration and foster design skills. This engagement gives students a comprehensive understanding of innovation and the skills to address real-world challenges innovatively and sustainably.

Evaluation Method

The evaluation method employed in this study aimed to assess the proposed pathway's effectiveness and associated activities. At the end of the learning journey, a survey was submitted to a sample of sixty students, primarily first-year MSc degree students. The survey encompassed targeted questions addressing key aspects of the methodology, including the effectiveness of team building and team working phases, the perceived importance of these processes, experiences during the community-building phase in light of pandemic conditions, evaluations of the Data Portrait activity and the functionality of the Miro application, perceptions of the practical approach in the Food Design Workshop activity, and feedback on critical thinking



development and outcomes in the Innovation Literacy activity. This comprehensive approach enabled a thorough evaluation of the activities' effectiveness and their impact on students' learning journey.

The survey included several key questions addressing different phases and activities:

- *Team Building and Team Working*
 - 1 How effective were the activities in promoting collaboration and teamwork?
 - 2 To what extent did students perceive these phases as important in the learning process?
- *Community Building Phase*
 - 1 How did the conditions imposed by the pandemic impact the intra-group relational aspects?
 - 2 What were the main challenges encountered during the community-building phase?
- *Data Portrait Activity*
 - 1 How did students evaluate the usefulness and functionality of the Miro application for achieving the course objectives?
 - 2 In what ways did the experience of creating Data Portraits enhance their understanding of the communicative impact of language through data?
- *Food Design Workshop Activity*
 - 1 How did students perceive the practical approach to the Systemic Innovation methodology?
 - 2 What were their opinions on using expired packaged food for an "aesthetic" design and prototyping activity?
- *Innovation Literacy Activity*
 - 1 How did students perceive the development of critical thinking and Innovation reflections in this activity?
 - 2 What were some notable outcomes or insights generated during the design solution generation and pre-concept development phases?

Fig. 6 Leonardo Moiso. *Learning path tools and soft skill. Modularization of the learning experience and tools used to enhance digital and soft skills.* Ph. Innovation Design Lab, 2021.

Results and Findings

The results indicated that the activities implemented in the pathway served as a distance learning solution, promoting interaction

between the students and enabling the continuation of teaching activities while preserving the learning objectives and enhancing digital and transversal skills. Integrating activities to support team building and team working proved effective in emphasising the importance of applying a method to these processes. The survey responses of the entire student sample revealed a high perceived importance for teaching team building (score of 3.91 out of 5) and team working strategies (score of 3.71 out of 5), emphasising the need to establish a dedicated teaching method for design courses in a blended environment. However, the community-building phase, which focused on relational aspects within the group, received a lower score of 2.80 out of 5, indicating its criticality and susceptibility to the challenges imposed by the pandemic conditions. In the *Data Portrait activity*, students expressed the importance of acquiring skills in using Miro, an application with functional features that facilitated the achievement of course objectives. They also recognised the value of understanding the communicative impact of language through data while acknowledging the need for further theoretical knowledge in this area.

The *Food Design Workshop* received positive feedback for its practical approach and ability to foster new interactions within the class group. Over 90% of the student sample appreciated the hands-on experience and the opportunity to directly apply the design method using workshop materials and tools and have fun. However, some participants objected to the use of edible materials for an “aesthetic” design and prototyping activity, despite the inclusion of expired packaged food.

The *Innovation Literacy* activity was evaluated positively for its contribution to developing critical thinking and Innovation thinking. It was noted that this activity had exciting spin-offs in generating design solutions and pre-conceptual development phases, further underlining its effectiveness in promoting creative thinking and problem-solving skills.

The results of the paper’s evaluation indicate that the activities of the proposed pathway were well received by the students, with positive results observed in terms of interaction, skills enhancement, practical application and development of critical thinking. The results regarding the quality of the project outputs and final assessment examinations remained in line with previous years of this course. The applications selected for the Systemic Innovation Design training model offer high visual customisation, allowing the learning designer broad organisational and communicative creativity of the content. At the same time, students are active participants in the learning process, developing descriptive and design outputs in groups that feed into the knowledge system of the class.

Conclusion

The article assesses a methodology applied in a digital learning setting, demonstrating that it promotes student interaction and upholds learning goals. It amplifies digital and cross-disciplinary skills, enriching the overall learning journey. The study highlights the vital role of educational methodologies in shaping digital environments, with the

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designer's expertise playing a pivotal role. Future research directions could explore the potential for further refinement of the methodology and adaptation to different educational contexts. Investigating the long-term impact of the methodology on students' skills development and exploring its scalability and transferability to other disciplines will be the focus of future explorations. Furthermore, practical applications of the methodology could extend beyond the academic context, finding relevance in professional development programmes or lifelong learning initiatives, where incorporating digital tools and educational methodologies can improve individuals' skills in a rapidly changing digital landscape.

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Material Practices in Transition: From Analogue to Digital in Teaching Textile and Fashion Design

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Abstract

The transition to digital design tools challenges the craftsmanship of textile and fashion designers as part of the product value chain, opening for reflection on how textile craftsmanship should be taught in education due to the current trend of digitalisation. By looking at new forms of craftsmanship, this research expands on the idea of teaching students transdisciplinary methods which connect analogue and digital tools within textile and fashion design education. Based on analysis of a number of case studies, we propose a framework of different strategies for teaching textile craftsmanship in the digital design age, with the aim of integrating textile-specific digital environments — which have been designed primarily to maximise the efficiency of industrial processes, rather than to enhance design development with regard to artistic expression — and non-textile digital tools on the basis that these are exploratory in nature and open to more creative design practices.

Keywords

Material practices
Teaching
Analogue craftsmanship
Digital tools
Textile and Fashion Design

The Role of Haptics in the Age of Analogue Craftsmanship

Prior to the age of digitalisation, the haptic dimension and analogue tools were generally employed in teaching fundamental skills in design education programmes. Compared to the role of visual observation in the design process, haptic perception informs about the physical features of materials that refer to characteristics such as roughness, compliance, coldness, slipperiness (friction), and weight (Tiest, 2010). Complementary, Zuo et al. (2014) make a clear distinction between the physical features of material textures based on the structural arrangement of the constitutive elements and how the texture is experienced and communicated based on sensorial perception. Moreover, haptic discovery connects the understanding of the material's physical and sensorial properties and communicates the necessary adjustments in forming and material craftsmanship. In referring to the quality of craftsmanship, Manzini (1989) associates the role of direct interaction with the medium of creation with modes of learning technical knowledge and selective processes leading to the refining of skills.

The first foundational examples for teaching textural qualities were developed at the Bauhaus, where the richness of haptic perception and importance of teaching multidimensional forms of expression by connecting the visual to the tactile were understood, and employed in the training of students. The exercises were based on material discovery, facilitating direct interaction with a large variety of textures and materials and experimentation with a diverse range of textural qualities and media of expression, including wood, metal, and textiles (Itten, 1975). Hence, the use of the descriptive language of material characters and properties was considered insufficient for enabling complex creative processes in texture studies.

Following the same line of thought, Groth (2016) stresses the importance of nowadays education through direct tactile and bodily experiences in craft and design. Physical prototyping supports cognitive and sense-making processes by connecting an ideal mental vision of a desired design to a possible reality, and enables the creator to communicate the qualities of the artwork to the user.

For textile designers studying, basic exercises in textural design have a fundamental role in integrating the sense of touch alongside visual expression in the processes of selecting materials (yarn qualities, printing materials) and textile techniques (weaving, printing). Addressing haptics as a sensorial dimension in the design process allows the designer to work with complex processes, connecting materials, tools, textures, and forms through direct experience with the artefact and understanding of the physical properties of materials.

Haptics in the Age of Digital Craftsmanship

Today, the increased influence of digitalisation on the creative processes of the artistic fields challenges the role of haptic knowledge and analogue environments in teaching and acquiring basic design skills. Thus, the extended transition away from analogue methods and towards digital tools in most design education programmes has moved the focus in teaching from haptic to visual media of expression and has challenged the use of conventional design methods (Kretzer, 2021). Consequently, digitalisation has lessened the importance of experiential knowledge and tactility in the process of artefact-making by amplifying the importance of vision and digital craftsmanship within creative processes. Digital media of expression offer the possibility to generate highly expressive digital surfaces, which are solely visual in nature and constituted by digital textures that utilise mediations of analogue characteristics (such as colour, transparency, dullness, and lustre) and digital variables (including reflection, refraction, specularly, and luminosity). In analysing the differences between analogue and digital craftsmanship, McCullough (2006) describes the direct manipulation of objects in real-time as one of the fundamental characteristics of digital craftsmanship, as the digital medium allows the designer to achieve similar artistic goals in less time.

Reflecting on the transition from analogue to digital design methods, Malins et al. (2007), discuss the positive tension that occurs in teaching design when transitioning from educating for traditional haptic skills to the digital medium emphasising the gain of a transdisciplinary dimension of knowledge that crosses the traditional borders of the established design professions. This hybrid knowledge synthesises traditional form-making processes based on the diminishing importance of material craftsmanship and experiential knowledge as compared to abstract digital creative processes based on logic and generative complexity. Gross and Do (2009) refer to educating for a new maker culture defined by cross-disciplinary creativity and openness to combine the established knowledge domains in digital and physical tools and processes.

The transition to digital tools and cross-disciplinary workflows has been widely established in object-based fields such as product design and architecture (Carpo, 2017). In the textile field, teaching methods for digital modelling and digital manufacturing techniques are at an early stage (Kwon et al., 2017). Subsequently, in material-based fields such as textile and fashion design the haptic dimension of material-making remains a quintessential aspect of teaching and learning textile structural techniques or fabric manipulation methods. However, the role of textile and fashion design as part of the product value chain faces large challenges at present that open for reflection on how textile craftsmanship should be taught due to the current trend of digitalisation of tools. This influences industrial manufacturing, the development of complex workflows, remote modes of production, assessment of sustainable material life cycles, and customisation of textile products. Moreover, the pandemic forced designers, teachers, and students to teach and to work on physical artefacts remotely, utilising digital tools and equipment in innovative ways and studying how they can be used to replace phys-

ical prototyping (Özdamar et al., 2021; Carpo, 2022). Today, a slow but progressive return to physical, in-person approaches means that the solutions found during difficult times are no longer replacing the old ones but opening up new opportunities. Thus, the field requires suitable methods of teaching complementary digital skills for material simulation to be established, and creative processes of structural design that can complement traditional haptic skills and the craft of hand manipulation and use of analogue equipment.

Exploring a Textile Perspective on Digitalisation: Research Approach

This research expands on the idea of teaching transdisciplinary methods that connect analogue and digital tools in textile design education to develop new forms of craftsmanship that emerge from the use of advanced digital fabrication methods, both textile and non-textile. Using a practice-based approach, the aim was to outline a space for digital textile craftsmanship that would expand the existing knowledge on analogue textile tools and material crafting in relation to digital environments. Knitting was selected as it allows the practitioner to work with the processes of material construction, object forming, and surface-texture design so as to link the material to the product. The aim was to broaden specialised knowledge of textiles by connecting craftsmanship to the use of the most advanced digital tools, such as digital environments for virtual sampling, and highly specialised machine-control software. The purpose of this was to generate suitable methods for textile- and fashion-design education programmes that would complement existing analogue skills with digital ones and add value to manual craftsmanship. This research opens up for reflection on a new profession that combines textile design training with current modes of connectivity in production, communication, and collaboration that are specific to Industry 5.0, the current industrial model (Nahavandi, 2019).

In the field of knitting design there already exist highly specialised digital environments for working with structural programming, surface imagery, materials, and three-dimensional visual sampling and customisation of textile products. These include SDS-ONE APEX for industrial machines such as the Shima Seiki and M1Plus for Stoll knitting machines, both of which can be used with garment-simulation software such as VStitcher and Clo3D. These digital environments require access to highly specialised software and machines and advanced knowledge of textile craftsmanship and technical programming. Exploratory creative processes that make use of these environments are generally assisted by a technician as they require special training in technical skills that are usually not provided by design training. Complementing these are non-textile digital environments such as Rhino 3D and Blender, which allow the designer to start with a basic three-dimensional drawing of textile structures, simulate and animate three-dimensional textile forms. These require knowledge of CAD software and facilitate work with more general-purpose, affordable tools such as 3D-printing and laser-cutting machines. As compared to specialised textile-design software and industrial-scale machines, which are constrained by

textile and fashion industry workflows, non-textile digital tools provide an exploratory character to design processes and open up for a more direct relationship with product design and architecture.

The case studies presented constitute four scenarios and ways of interaction between the haptic dimension and digital environments for textile and knitting design. A two-fold approach was used:

- First, from a practice-based research perspective using the designer's standpoint, interactions were explored with regard to expanding the range of tools and design processes to generate new methods to teach new forms of hybrid craftsmanship.
- Second, from a pedagogical standpoint, how interactions can enhance the teaching and learning process was explored, as was the generation of updated tools and methods to improve the learning experience and obtaining of both manual-haptic and digital skills.

A Framework for Teaching Textile Craftsmanship by Mixing Analogue and Digital Tools

As result, we propose a framework of methods Fig. 1 that relate analogue and digital craftsmanship to specialised textile and non-textile tools in design processes. The purpose of this is to elaborate on and offer different strategies for teaching textile material practices in the digital age, with the aim of integrating textile-specific digital tools — which have been designed primarily to maximise the efficiency of industrial processes, rather than to enhance design development — and general-purpose digital tools, which provide an exploratory character to design processes and open up for perspectives from a diverse array of fields.

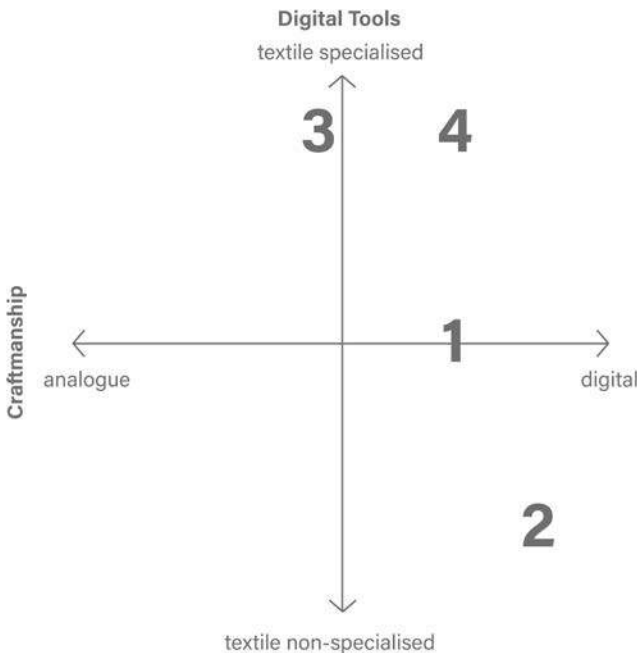


Fig. 1
Position of the case studies according to the type of necessary craftsmanship skills and type of modelling environment used, by Authors.

1 Implementing digital craftsmanship in specialised digital textile environments and non-textile digital environments. This method involved two approaches to combining digital tools and material-fabrication methods using a specialised digital textile environment for knitting design (M1Plus) and non-textile digital environments such as Rhino 3D and Grasshopper for 2D and 3D pattern-generation and simulation. These 2D patterns were printed on textiles using three-dimensional filament-printing technology and applied to a previously produced knitted base, which was prestressed. The result was a hybrid collection of three-dimensional textile composites with self-folding and -forming behaviours **Fig. 2**. The advantage of combining these two approaches in teaching was that it facilitated work with haptic qualities of textiles such as feel, weight, and elasticity and 2D surface design and the formation of a complex three-dimensional form in a digital environment. This led to the development of forming skills relating to the combining of soft and stiff material behaviour (Dumitrescu, 2021), and simplified the knitting process so as to achieve complex textures by adding a new technology, resulting in three-dimensional textures and forms.

The process emerged from a dialogue between:

- the haptic experience of knitted structures;
- material hybrid fusions to generate self-folding and -forming behaviours;
- 2D pattern design and forming of textures in a digital environment such as Rhino 3D;
- acquiring new craftsmanship skills in a non-textile fabrication method: three-dimensional filament-printing technology.

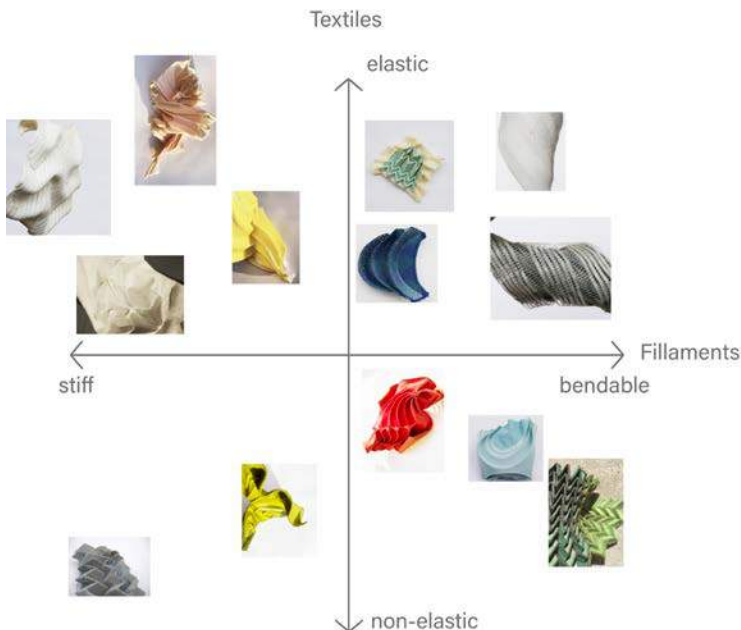


Fig. 2
A diagram for structuring samples for teaching hybrid materials based on form and material behaviour according to the textile elasticity and the flexibility of the 3D printed layer, by the author.

2 Implementing haptic knowledge of textiles in non-textile digital environments to generate digital textile expressions- This method references the process of transposing physical textile craftsmanship into a non-textile digital environment and modifying it to alter conventional textile expressions, facilitating creativity in the digital environment Fig. 3. The diverse array of actions challenged the flat expression of textiles, resulting in novel, three-dimensional interpretations with enhanced haptic visual expressions. The case uses background knowledge of knitting using analogue and digital tools to generate different structural designs. The aim was to translate reality-based images that could then be manipulated into new textural forms through non-textile digital tools. A method to animate cloth in Blender was used to explore the dynamic forming by draping of digital textiles; this exercise focused on the explorative process of surface, environment, and form. The digital draped fabric forms which were created in Blender were translated to Rhino 3D. Here, the forms were further explored as volumetric textures by applying the digitalised knitted samples. The process enabled the creation of complex coloured textural forms that could later be 3D printed.

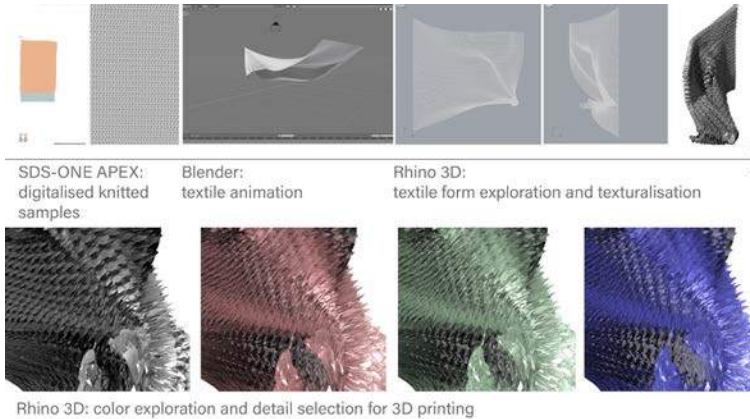


Fig. 3
A workflow diagram illustrating the different steps of the design process, by Author.

3 Implementing analogue craftsmanship in specialised digital textile environments. This method used haptic and analogue experience and specialised digital tools to improve the learning process in terms of both analogue and digital knowledge. During the process of learning knitting skills, understanding knitted structures and physically touching materials are fundamental. This knowledge has always been obtained through touch and making hundreds of analogue samples, developing the ability of practitioners to predict the physical features of a final outcome. Today, digital environments for knitted textiles simulate what has been programmed using coding for industrial machines. In this case study students were asked to work in both physical and digital environments, following a series of steps during which they:

Designed and produced a physical knitted sample.

- Programmed the same sample in the SDS-ONE APEX3 software package.
- Simulated the sample by inputting all of the information regarding yarns, structure, and colours into the digital environment, using the skills learned as a result of manual experience.
- Knitted the simulated sample to create a second physical version, and compared this to the one made manually during the first step.

This process Fig. 4 taught the students how to use digital tools to predict analogue results and to use analogue experience to work in digital environments, generating a cyclic enhancement of both domains of knowledge.

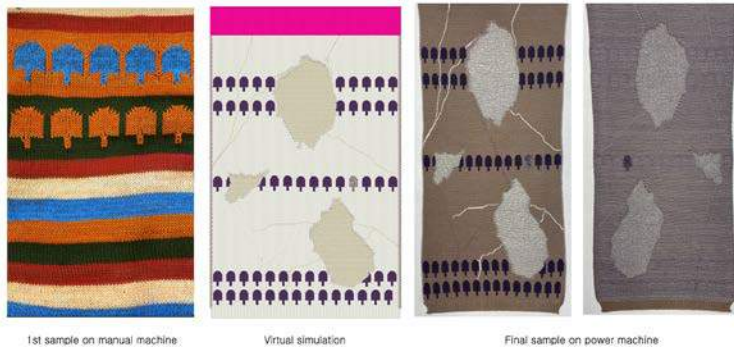


Fig. 4
The evolution of samples from manual to electronic machines, through the virtual simulation. Design and production by Ida Belli and Lorenzo Costanzini.

- 4 Using specialised digital textile environments to implement understanding of analogue processes and structures. As is discussed above, learning how to knit is a process that requires an understanding of structures, namely how the yarn becomes a three-dimensional fabric. The more the yarn interacts with the needles in different ways, the more varied and complex the structure becomes, generating endless design possibilities. This learning process has always been a “learning-by-doing” process, where the understanding of what is achievable happens through trial and error. Today, the software used to program machines has a feature that simulates the machine while it knits the structure that has just been programmed, showing all of the movements of yarn feeders, needles, and yarns Fig. 5. This dynamic virtual simulation makes it possible to observe what happens inside the machine, where the needles are usually hidden far from the eye and safety mechanisms prevent direct intervention. The tool, which was originally designed to allow technical specialists to check the program, was transformed into a learning tool for design students of both basic and advanced levels. The tool allows beginners to:
- Observe how the yarn can be used to make basic structures.
 - Understand how needles and yarn feeders work.

- Identify correspondence between manual and industrial machines.

More advanced users can use the tool to:

- Understand complex structures.
- Expand their knowledge of structures through exploration and experimentation with machines.
- Anticipate and understand possible errors, quickly and with less material wasted.
- Explore a wide variety of design possibilities.

Discussion

The case studies exemplify diverse ways of approaching the teaching of material design in textiles and fashion field, wherein haptic knowledge is combined with digital media, and show four possible paths that practice and processes within textile design can take; these extend out from the creative core of the research presented and encompass the digital technologies available. These can be used to generate new forms of textile craftsmanship, wherein haptic textile knowledge maintains its importance and is worked with in a systematic way in the digital realm. The results of each case study were improvements in terms of both design outcomes and skill development, and assessments of different positioning within the framework show that there are multiple pathways for further research and practices that could be positioned anywhere between the four axes of the framework in terms of finding new ways of helping the haptic and physical craftsmanship to interact with the virtual and digital tools. The results of each case study exemplify the positive impact of a cross-disciplinary approach, and the benefits of combining tools in terms of both design outcomes and practitioner development.

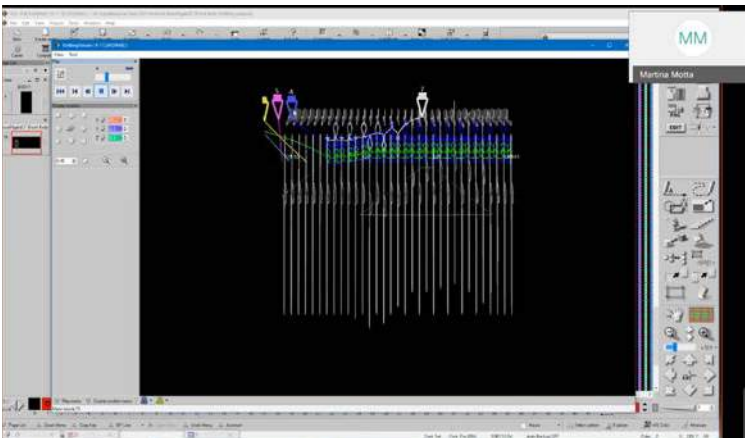


Fig. 5
A screenshot of Shima Seiki Apex3 interface showing the virtual simulation of how the machine performs the programmed knit sample including the movement of yarns, needles and yarn feeders. Produced by Authors.

Digital environments are increasingly supporting the rapid changes in approach to industrial production that we are experiencing: after a decade of Industry 4.0 we are now approaching Industry 5.0, which is centred on symbiosis between human and machine (Longo et al., 2020; Xu et al., 2021) while maintaining respect for the planet and workers' wellbeing (Breque et al., 2021). Here, shared workflows and cross-disciplinary practices complement an integrated perspec-

tive on the product value chain, extending from material to product and end-use (Gloy, 2021). Designing, teaching, and learning about hybrid material-based practices, as takes place in the field of textiles, requires new tools and methods with higher levels of digitalisation, and so there is a necessity to implement holistic perspectives on processes relating to design and textile-making which transcend conventional professional boundaries that are based exclusively on analogue and digital craftsmanship and tools, and which will ensure responsive innovation paths.

Textile and non-textile digital tools are of equal importance when teaching textile design, as both enable the development of creative processes and provide knowledge and skills with which to realise design visions. This research sought to emphasise the design possibilities afforded by each, and to reflect on the need to teach students about the diversity of digital environments to ensure the development of sustainable textile-based practices.

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Designing for the Future of Education Through Cultural Heritage

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Abstract

In recent years, cultural heritage has taken up a broader purpose in Europe, becoming a substantial tool for social enhancements and economic gains. One of the bigger purposes of cultural heritage is its relationship with the education sector. Despite the efforts made to recognize the potential of cultural heritage in education, we cannot turn a blind eye to the challenges facing the education sector nowadays. Designers of today realize that the field of education has been subject to various disruptions over time. The current use of technological tools in the cultural sector has facilitated a new relationship between cultural heritage, communities, and education. Similarly, it is up to the designers to reconsider the methods through which knowledge can be produced and consumed in the education sector. In this contribution, we will explore the use of digital tools for participatory approaches in experiences collected from two distinct projects.

Keywords

Cultural heritage

Identity

Technology

Education

Design as process

Conceptual Framework

Cultural heritage is now acknowledged in Europe as a tool for providing benefits on both social and economic levels. It encompasses the creation of identity, the improvement of life quality, the formation of social cohesion, as well as the engagement of local communities and their empowerment (Ferrilli, Sacco, Blessi & Forbici, 2017).

After years of research supported by the European Union (EU), the notion of heritage has expanded beyond tangible and intangible goods, to embrace landscapes, rural and urban areas, digital archives, and other new domains. The EU has also highlighted two main themes for cultural heritage which consider it as *a vehicle for cultural identity* and *a medium for economic development*. According to the *Lisbon Treaty*, the role of the EU is to ensure the safeguarding, enhancement, and promotion of Europe's cultural heritage (art. 3.3.), while recognizing diversity and bringing forth shared attributes (art. 167 TFEU) (European Commission, 2007).

The Faro Convention, among other significant policies developed by the European Commission (EC), stressed the role of individuals and communities, and suggested the safeguarding of values associated with cultural heritage (Council of Europe, 2005). In the report *Getting Cultural Heritage to Work for Europe*, the EC considered the advantages of cultural heritage, and recommended the formation of policies and an agenda for cultural heritage research and innovation (European Commission, 2015). In 2018, the EC launched *the European Year of Cultural Heritage* to highlight the opportunities and challenges derived from Europe's shared cultural heritage. The theme focused on safeguarding cultural heritage and promoting innovative solutions for social, cultural, economic, and educational problems (European Commission, 2018). Moreover, the *Innovation in Cultural Heritage* research acted as a benchmark for completed, on-going, and prospective EU funded research on cultural heritage. It focused on six main themes: European identity formation; tangible/intangible in an urban context; assessing place and events; intersectoral cooperation; cultural heritage communities; and digitalization of cultural heritage (European Commission, Sonkoly & Vahtikari, 2018). The *New European Agenda for Culture* included among its key actions social objectives, economic goals, and international cultural relationships. It also discussed the ten initiatives presented in the 2018 *European Year of Cultural Heritage*, under the four pillars of engagement, sustainability, protection, and innovation, to ensure their impact on the future of cultural heritage (European Commission, 2018). This approach has also been incorporated in the *New European Bauhaus*, which considered cultural heritage as an integral dimension for connecting science, technology, art, and culture (Europa Nostra, 2020).

Despite the efforts made to recognize the potential of cultural heritage, it remains a vague concept. Thus, the role of cultural heritage must be revitalized to ensure its valorization and the formation of social and economic benefits. According to Celaschi & Trocchianesi (2004), promoting knowledge through design could be the way to enhance cultural heritage and connect it with its users (Celaschi & Trocchianesi, 2004).

Enhancement of Cultural Heritage and Education

The definition of “*enhancement*” of cultural heritage, as found in the *Code of Cultural and Landscape Heritage* (art. 6 par. 1), states it as “the activity aimed at promoting knowledge of cultural heritage and ensuring the best conditions for its utilization and public enjoyment” (Code of the Cultural and Landscape Heritage, 2004). Since education is a process through which we create and gain knowledge, then we assume that it is vital for the protection, recognition, and appreciation of the values of cultural heritage (Petraoia, 2014). There are several policies that promote cultural heritage education and training. The *Third National Plan for Cultural Heritage Education*, for example, consists of strategies fostering the involvement of a variety of stakeholders to find innovative solutions for educational problems and promoting the use of digital tools. Other strategies include the *New European Agenda* initiatives, which act on integrating culture in education, increasing accessibility, raising awareness, promoting citizen participation, and fostering social innovation (European Commission, 2018).

Looking at the actual education system, we perceive a backwardness in meeting the challenges of the 21st century, which must be confronted by changing the current approach (Hannon, Thomas, Ward & Beresford, 2019). In light of the pandemic, the education system experienced a disruption in its existing paradigm. However, seeing the pandemic as a window of opportunity, designers began to rethink the education sector. The increasing adaptation of technological tools in the cultural sector of today made it possible to facilitate new links between cultural heritage, communities, and education. This cross-sectoral approach has also been highly acknowledged in the museums and education sector relationship.

Although we traditionally view education in terms of classrooms, there is an increasing interest in learning that takes place in museums. As stated in the *Guide for Local Governments, Communities and Museums*, museums must be recognized for their role in the education and training of youth on cultural heritage (OECD & ICOM, 2019). Thus, museums can become real engines of economic and social change. Through proximity strategies and a *win-win* logic, they can support economic activities such as those of the cultural and creative industries or the tourism sector. Through the idea of community museology, museums can also support social cohesion and community identity.

The OECD & ICOM (2019) *Guide for Local Governments, Communities and Museums* suggests five themes for museums and local and regional governments seeking to maximize the local development impact of heritage:

- 1 The power of the museums for local economic development;
- 2 The role of museums in urban regeneration and community development;
- 3 Culturally aware and creative societies;
- 4 Museums as spaces for inclusion, health, and well-being;
- 5 The role of museums in local development (OECD & ICOM, 2019).

Initially, museums were designed to increase cultural awareness and education. Over time, they assumed more complex roles such as training and life-long learning, not just for native populations, but also for immigrants and other marginalized communities. The primary mission of museums is to promote self-awareness and change in the way people think about past and present issues. By displaying an inventory of past creations, they help us understand why and how objects have been created, thus promoting a broader creativity culture. According to Roca (2018), we assume that museums are at the crossroads of a revolution:

- Narrative Revolution: Providing knowledge based on solid foundations and not just sentiment. Following the principles of *Responsible Research an Innovation* approach (RRI) and avoiding the spread of false information;
- Property Revolution: Without artifacts and records, museums resemble a coin that does not inspire trust. With the aid of digital tools, face-to-face experiences can be enhanced, and physical visits simulated;
- Organizational Revolution: The museum's internal organization and its relationship with public administrations have become flexible and more interconnected;
- Citizenship Revolution: Through effectively mobilizing knowledge, museums can promote awareness, beauty, and the city;
- Tourism Revolution: Through the use of digital tools, new experiences are created for visitors (Roca, 2018).

Being public institutions of knowledge, museums can break the barriers between academics and citizens, tradition and innovation, and local and global. As Colombo (2020) stated, "participatory practices are important forms of restitution, the symbolic value of which is exactly the opposite of the hostage museum of an intellectual self-referential elite, unable to negotiate and meet" (Colombo, 2020). Participatory practices in museums enable research and innovation by making use of rigorous and academic knowledge. With only a few resources and a *win-win* model, museums can create a common standpoint for culture, territories, and social organizations. In addition, digital technology allows this approach to grow and encourages the idea that anyone can be a producer of culture. The survey by *the Digital Innovation Observatories* of Politecnico di Milano has coined a new term to express the hybrid environment that has enriched the cultural experience. This term is referred to as *phygital*, and it expresses the combination of both a physical and digital cultural ecosystem. It is made up of physical environments including museums, cultural centers, archaeological parks, and digital platforms such as social networks, e-commerce sites, and blogs, that when combined can enable innovative relationships with the public. During site visits, digital tools promote engagement and personalized and interactive experiences, while online channels prepare for the site visit. According to Simon (2010), we consider three typologies of cultural engagement: user generated content; sharing; and capacity building (Simon, 2010). The third typology has been considered for *BE-HERE*, a project interested in the acceleration of cultural innovation. The project adopted a platform through which local communities can be involved and transformed into a storytelling

community. The idea is based on redefining the concept of collection and shifting from a curatorial process to a co-creation one. The project is activated by the stories that matter to people. Starting from these stories, the museum was able to design an exhibition. From the start, this project was aimed at ensuring relevant and successful participation. The *co-creative approach* allows people to replace the experts at the center of the curatorial project and gives their stories an equivalent value to that of museum collections.

Digital Technologies for Cultural Heritage and Education

During the pandemic, museums retained their educational role by turning to digital tools. This was the case of various museums worldwide, such as the Tate Museum (Tate Museum, n.d.) and the Museum of Modern Arts (Museum of Modern Arts, n.d.), which provided online access to diverse mediums such as videos, audios, games, and quizzes to provide art lessons for children. Museums in Italy implemented similar actions to support informal learning for students through their structures. This was the case in Bologna, where access to virtual tours of the medieval city was granted. The Civic Museum of Natural History in Piacenza also offered a series of online workshops for students to enrich their distance learning experience during the pandemic (Museo di Storia Naturale, n.d.). Another example is that of the Art Stories initiative of the *Bartolomeo Cultural Association*, where students navigated through various cultural heritage sites and listened to narrations about the arts, history, and architecture (Art Stories, n.d.).

According to Colombo (2020), knowledge transmitted through museums often arises from the emotions experienced in front of an object and develops through an inductive process (Colombo, 2020). This experience-based knowledge helps increase empathy, understanding and appreciation. Thus, it is important to treat the visit as an experience, not only based on communicating but also on listening.

The questions we must address are: “What are the materials that teachers can draw on? And what dynamics should change the frontal lesson?” These issues were the focus of the two research projects, EDU.C.A.TE and ARTERI’A, conducted by lecturers and researchers of Politecnico di Milano and University of Bologna¹.

The *EDU.C.A.TE* project, involving the Management Board of the UNESCO Sacri Monti of Piemonte and Lombardia and the Lecco Laorca Lab Association, combines education with cultural heritage and technology. The aim of this project is to find innovative solutions for the valorization, safeguarding and sustenance of the above-listed cultural heritage sites. The project believes in enabling local communities through knowledge, leading to their active participation in the decision-making process. This aim was pursued by the digitalization of the sites to engage different communities or groups, such as inhabitants, cultural institutions, and designers, in the design of new material for educational activities. Through education, this project connects the three main aspects of society, science, and technology (Fanzini, Achille, & Tommasi, 2021). Through the activation of train-

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The working group of the EDU.C.A.TE project is composed of Prof. Achille Cristiana, Prof. Daniele Fanzini and Dr. Cinzia Tommasi, PhD. The working group of the ARTERI’A is composed of Prof. Flaviano Celaschi, Prof. Daniele Fanzini, Laura Daglio, PhD Nour Zreika, and Eng. Angelo De Cocinis. The research works collaborate with an artist group composed of Mario Branca, Andrea Rossi, Fausto Bessi, Federica Rossi, and Gabriele Rossi.

ing courses at middle school and high school levels, students were made aware of the cultural significance of these sites and acquired information around their history, cultural value, prospects, and challenges. At the middle school level, students were invited to discover the sites, recognize their history, and understand the meaning and importance of cultural heritage. At high school level, students were encouraged to interact with the local community, collect tangible/intangible data, conduct surveys, and use digital tools. As an outcome, this project allowed younger generations to be aware of their heritage and to come up with their own enhancement projects.

The *ARTERIA* project involves the Vigolzone Municipality and the *Cultures for Local Development* Association. Starting from the EDU.C.A.TE experience, the research aims to create a project HUB within the headquarters of the former Municipal Civic Center of Vigolzone to activate local development initiatives on the basis of cultural and social impact. This objective emerges as a response to the changing needs of the patrons of the Municipal Civic Center of Vigolzone, who started as simple users of cultural services and transformed themselves into advocates of local culture, as well as providers of new services for locals and visitors. The project gave rise to the opportunity of reactivating the abandoned Val Nure railway that once connected the tourist destination of Grazzano Visconti to the other cities in the valley. This disused physical infrastructure will be transformed into an intangible pathway for promoting new uses of the territory. Not only will this project restore the physical aspect, but it will also revive the historic memory of the railway through the creative intervention and resourcefulness of the citizens in the area. A fundamental prerequisite is therefore to enhance the design skills of the participants by supporting the combination of expert and non-expert knowledge and using technologies for enabling co-design. The fundamental ingredients of this proposal are places and their historical values, citizens and their local associations, experts contributing to the creative process, and IT technologies for conducting extensive and ethical exercises on collective creativity and carrying out virtual prototyping of proposed solutions.

The design exercises aim at empowering local citizens to lay the foundations for the project HUB in the Municipal Civic Center of Vigolzone. The on-going activity includes the following:

- Historical/environmental surveys to highlight the characteristics of the places and their possible evolutionary prospects;
- Seminars to initiate the design activity, detailing of organizational agreements, and aligning of operational aspects;
- Creative workshops for participatory planning and co-design and involving experts, young creatives, the inhabitants of the area, and potential visitors. The workshop foresees a phase of creative divergence, followed by a phase of convergence, relating the proposals to a strategic action framework;
- Digital prototyping and virtual staging of proposals and solutions outlined by the working groups;
- Evaluating ideas and proposals through the organization of contests and exhibitions;

- Realizing in real-life the proposal with the greatest number of votes;
- Enhancing the results by creating a digital catalog for all proposals of the Living Lab.

Grouped into three macro-areas, these activities intend to:

revive, through artistic creations and projects, the traces of a disappearing railway, and reactivate the system of flows and relationships that once nourished the territory and its capitals; concentrate the design intervention on a few representative thematic stations; pursue the quantitative and qualitative rebalancing of tourist flows which are currently concentrated in Grazzano Visconti. Thus, the railway will take on the function of a cognitive infrastructure for the reactivation of internal ties to the territory. The outputs of this project consider both the works of citizens and experts alike due to the numerous actions of the civic center and the cultural associations present, and the digital co-design platform that will be tested throughout the design activity. This platform will enable the prototyping and virtual staging of the works and their use in immersive and augmented reality. Since the platform will be tested throughout the project, it can be easily transformed into a scalable process/product for other cases where *design thinking* principles can be adopted to address similar issues.

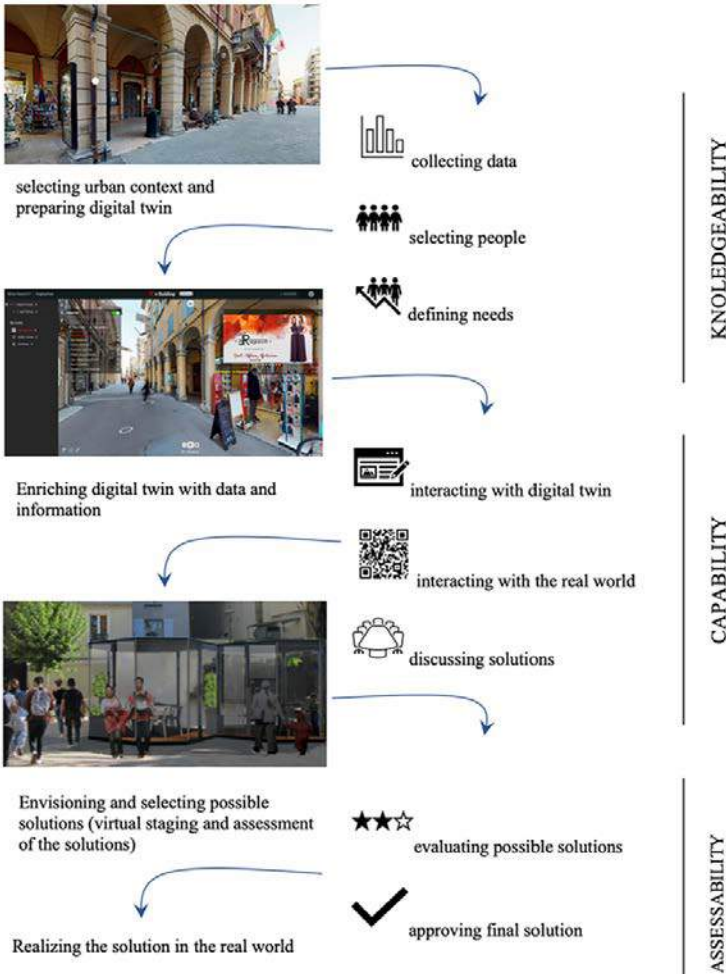


Fig. 1
Workflow of the Design Process. By Fanzini, D. 2022.

Conclusion

In light of the above, how can designers benefit from these experiences? And what must they consider for the future of education?

Design has become a mediator of the production and consumption systems. According to Celaschi & Formia (2010), we can assume that design is “the spark that triggers the need for innovation and the master over decision making” (Celaschi & Formia, 2010). The education sector, which has seen several disruptions over time, most recently during the pandemic, includes one of the many challenges that designers now face. As suggested in this call, designers acknowledge that the production and consumption of knowledge in the education sector must be reconsidered.

Therefore, to answer the previous questions, this contribution highlights the role of schools and the importance of cultural heritage education. It considers schools as the laboratories in which designers test their different methods. We must not only consider what the designers can give to the future of education, but what education, in the form of schooling, can provide the designers. Therefore, schools and cultural institutions must work closely together to create incubators where students actively participate in the design and decision-making processes related to cultural heritage. The knowledge these students acquire is based on formal (through schools) and informal learning (through intergenerational dialogue, interaction with cultural heritage, and engagement with local communities) (Hannon, Thomas, Ward, & Beresford, 2019). This contribution suggests that informal education must be considered as a formal learning tool. The expected outcome of this research is a model that can be implemented for the education of the future, where schools become think tanks for designers, stakeholders, and policymakers. This model can be reproduced and adopted as a permanent solution for cultural and education sectors.

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We Need to Talk About Learning Design. A Proposal for Critical Conversation

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Abstract

Conversations about how design learning moves toward its preferable future are critical. This paper discusses a hybrid area of investigation across Futures studies and Design Research that informs thinking toward a design education imaginary, as part of a larger body of work addressing pedagogical innovation. It sets out discursive approaches for connecting knowledge, and investigates the role that narrative might play in enabling that future to be imagined, visualised and enacted. The paper introduces a process — a tool, currently in early phase testing — through which discursive, community knowledge might be collected for application within existing systems and processes. The paper proposes critical conversation as a form of making, as a device for creating the future story in, and of, design learning, pointing toward a new chapter for design education where it might expand to truly make sense of the world around learning.

Keywords

Design learning
Discursive design
Critical futures
Creative pedagogy
Design futures

Introducing the Discussion

If designers stand between revolutions and everyday life (Antonelli, 2008) then design must concern itself with future-making (Yelavich & Adams, 2014). And if, as curator and author Paula Antonelli (2019) states, design can spark and fuel the reboot needed for the future, then it should lay down the potential conditions for systems, societies, and relationships that nurture “responsible anthropocentrism beyond the modern human” (Escobar, 2018). In questioning how design can contribute to dampening the compulsion to think and act like modern individuals, whilst forming an ethics of autonomous inter-existence, Escobar highlights the need for design to foster convivial reconstruction beyond the cultures of expertise.

Situating the Research

This paper introduces an early phase research activity situated in a Discursive Design (Tharp & Tharp, 2018) space: a model for stimulating restorative dialogues around the preferable futures (Mitrovic et al., 2021) of design learning, which compliments ongoing research into framing new dialogic and participatory pedagogical approaches (Martin, 2022a) that intervene in the design education system (Martin, 2022b). The research proposes critical conversation as a form of making, as a tool for creating the future story in, and of, design learning. The research applies Critical Design and Futures research to a design education imaginary. The supporting research embodies emergent thinking around Critical Futures as a hybrid area of research (Candy & Koronet, 2019), actively incorporating Critical Speculative Design (CSD) (Mitrovic, 2015) as a method to emancipate a participatory agenda. The activity is a form of communication design: a held space (Brown, 2021) for collected perspectives that form a community conversation about the future of design learning, and thereby, design.

Positioned within the Critical Futures field, utilising designed tools and artefacts to create relevant experiences, theory and practice (Jonas, 2015), this collaborative writing-as-learning (Fung, 2010) activity is part of a larger body of research testing modes of distant, slow design (Hallinas & Redstrom, 2001).

Structuring the Future Story

The future is a realm of ideation and imagination, it can only be experienced through images, thoughts, feelings and the multiple ways these are subsequently expressed in the outer world (Slaughter, 2018). It is an intellectual and cultural construct that helps shape actions in the now (Dator, 2005; Polak, 1973; Candy & Potter, 2019). Critical Design creates space and provocation to ask questions about what is wanted, envisaged and why we might imagine a future. By stimulating discussion and debate, Critical Design moves designers, participants and stakeholders toward critical reflection and response (Dunne & Raby, 2001).

Futurist researcher and educator Jose Ramos (2006), raises the need for Futures work to move beyond academia. They suggest that by embodying communication strategies, the field could begin to develop into a hybridised practice that is caring and explores epistemology through reflexive practices which opens it up to “collective acts of empathy, conversation and deliberation in the public sphere” (Candy & Potter, 2019). This provokes an ontological shift that transforms how design is viewed, heard, felt, thought, understood, explained and done (Fry, 1999). Critical Futures is an emergent field that brings together Critical Design, Futures studies, Foresight and Design. It moves toward articulating and mapping, and communicating, images of the future in a wide range of mediums and approaches (Candy & Dunagan, 2017).

Modelling the Future

Anthropology theorist and foresight researcher Robert Textor (1985) advocates for anthropological knowledge and ethnographic methods to be modified to focus on the anticipation of change. The Ethnographic Futures Research (EFR) method, is a three-cycle protocol for systematically mapping existing images of the future held by various individuals within communities, across optimistic, pessimistic and most-likely future scenarios. It could be understood as Participatory Design (Schuler & Damioka, 1993) falling under risky participation (Huybrechts et al., 2014), and aligning to the Cone of Possibilities (Taylor, 1988) used by Critical Speculative Design (Mitrovic, 2015). The EFR empowers and proactively supports those involved to see their place in the future through incorporation of storytelling tools that build trust.

Building on the protocols for adapted cultural anthropology and ethnography that Textor (1995) develops, researchers Stuart Candy and Kelly Koronet (2019) develop a set of approaches that bring ethnography closer to futures studies in an Ethnographic Experiential Futures (EXF) model. By facilitating visibility, tangibility, interactivity and exploration across a range of modes, it's ambition is to act on the calls for greater capacity for foresight (Slaughter, 1996; Ramos, 2016; Fry, 1999). Described as a workflow, the EXF presents an adaptable sequence that could be applied broadly in other projects to structure a shared language (Sanders & Stappers, 2012) for the generation of knowledge and expand the capability of Futures studies.

The Futures Action Model (FAM) (Ramos, 2013) is a creative methodology for guiding participants through imagining and learning a future, moving from foresight to innovating around known problems. Ramos describes it as a form of anticipatory action learning, which, following Inayatullah (2002), locates futures and strategy together in an action-based, engaged learning cycle of planning, acting, observing, reflecting. From the perspective of design learning, FAM aims to understand the meaning [of designing] (Schön, 1987), not the tangibility of the experience [of learning or of designing], nor outcomes of the action. Schön (ibid) outlines

that an approach to responding to uncertainty and instability might follow three concepts: knowing-in-action, reflection-in-action, and reflection-on-action.

Following this thinking, is the process for Self-Regulated Learning (SRL) by researcher Barry J. Zimmerman (2000), which informs a model for SRL by architect and researcher Thomas Kvan (2001). The combination of these, with consideration of Koschmann's (1994) Problem Based Learning model, creates a recurring three phase model of forethought, performance and reflection which embraces a social constructivist view of the role of cognition and collaboration in knowledge generation (Gergen, 1995).

Psychologist Lev Vygotsky (1978) states that there is an optimal point for learning development, which occurs in a space informed by the participant's own pre-existing knowledge rather than an arbitrary beginning point nominated for a group or uniformly prescribed for all. Vygotsky points to the importance of knowing where the edges of pre-existing knowledge lie, the relationships and community structures within a learning space which can socially scaffold interactions and learning experiences.

Discussion and Dialogue

Building upon Critical Design language (Dunne, 1999; Dunne & Raby, 2001) Discursive Design is a practice of objects, interactions or services that act as tools for thinking (Tharp & Tharp, 2013) whereupon substantive ideas can, and should, be conveyed in the form of design communications. The role Discursive Design plays is, firstly, intellectual, acting as a precursor to preferred action, or as preparedness for future activity. It is described as behaving in a similar manner to research tools that engage potential users and produce insight into their hopes, dreams, values, concerns, behaviours. There is a need for designers to merge action and speech within their reflective practices, as a reaction to the current state, and world (Staszowski & Tassinari, 2021). Dialogic Design can be described as the "practice of structuring collective language and non-verbal discourse to enact design processes" (Sanders & Stappers, 2012), in design research the role of dialogue is underdeveloped, a range of methods could be employed in design fieldwork and knowledge translation to enhance its capability (Jones et al., 2006). A level of deliberate ambiguity and open-mindedness is often leveraged with the use of discursive and dialogic instruments, design researcher Bill Gaver (2003) argues that ambiguity allows designers to "suggest issues and perspectives for consideration without imposing solutions... while renouncing the possibility of dictating answers."

Story Building

Storytelling, as an act, effectively communicates between two domains of embodied (working knowledge used in everyday situations) and codified (abstract and symbolic type gained from books, reports etc.) knowledge (Bauman, 1986). In story-telling, patterns are created, and sought, which help [humans] to navigate the world and in design, people [and others] are invited to enter a “scene” to explore it in a sensory, textual, interactive or experiential manner (Lupton, 2017).

A storyboard for a Generic Foresight Framework by Futures strategist Joseph Voros (2003) follows this concept of narrative building. It plays across four scenes: look and see what’s happening (Input); what seems to be happening? (Analysis); what’s really happening? (Interpretation); and then, what might happen? (Prospection). Voros states the output of this narrative journey is to ask ourselves what we might need to do, and to develop a strategy of what and how we will do it.

Collaborating Through Writing

In Participatory practice makers relinquish ownership of the project in open-ended negotiation with uncertain, difficult or unpredictable outcomes (Huybrechts, 2012), and it is this de-authorship (Bishop, 2006) that enables a process of de-familiarisation whereupon the experience may be collaged together from the participants respective worlds (Muller, 2002), with all their prior knowledge and experiences.

Collaborative writing can be understood as utilising social interaction to create learning through the process of writing. Writing together to learn is an act which introduces mutual interaction, negotiation, conflict, and sharing of expertise through collaboration (Fung, 2010). Through mutual engagement in this act, participants establish a recognisable “community of practice”, which informs the development of a social collective identity as a community around an activity (Vygotsky, 1978).

A group of scholars — self-identifying as JKSB — embody reflexive, participatory learning through writing, applied as a collaborative action research method. Using storytelling (Pace, 2012; Ellis et al., 2011) to elucidate, in practice, the theories of Deleuzian thinking the group write to open up their on-going lives to new becomings in the space of the others as an elaboration of the human condition (Wyatt et al., 2014). Author and key member of OuLiPo (1960), a “workshop for potential literature”, Georges Perec, along with other writers and mathematicians, explore the application of word games and formal constraints within literature. Through collective action, they introduce disturbances in their texts, and rules to scaffold different ways of writing, reading and learning within the acts themselves. Their interventions shift the perception of the written or read texts.

The Discursive Design Thing

Originating with the idea of changing complex systems through cumulative activity that builds toward transformation (Thackara, 2015), a Discursive device is designed as an act that supports intervention in the design learning system. Across two cycles, this action research Thing (Björgvinsson et al., 2012) stages a collaborative model for future story-making, and through that, a co-created narrative which maps a new future for design pedagogy. The Thing is a tool for shaping the early stages of a community dialogic process. Following Schön (1987), Ramos (2013) and Koschmann (1994) the Discursive Thing collects thinking, connects threads of the collective narrative and commons the key talking points for action inside and around design learning. The research activity attempts to frame knowledge, and create scenarios for wider, open engagement in the transformation of design education. In doing so, it hopes to emancipate design learning from the limits of the Anthropocene as we move through this next, everyday revolution.

Action Research Cycle 1

In the first cycle, the design brings together a curated range of participants in a slow design writing activity following the Exquisite Corpse — a game initiated by artist André Breton and peers (1925) — as a model of critical design discourse. Each participant sequentially engages in a written, informal dialogue Fig. 1–5. As the start-point for each new conversation, the participant receives the final piece from the previous conversation. Using the Golden Section as a guide, participants are initially proximate to design learning, and the Design School model (as understood from a situated context in the global north) but as the activity unfolds, participants from more diverse geographical and philosophical positions are enfolded. The ambition is to manifest a collected, community narrative tracing threads of a global, dispersed dialogue about design and creative pedagogical futures, with the intent of capturing a real and divergent story for design learning.

25/02/20 11:14 AM

For a while, I blamed the institutions as a whole, and self-obsessed faculty members in particular. Then I blamed myself, for being ineffective. Finally, I learned that institutions do not change because you tell them to do so, nor even when you show them how. They change - or not - when their context changes. So, for me, messing about at the edge is my way of intervening in the context - in the hope that the context will shift and, then, so will the institutions.

25/02/20 11:14 AM

I wondered if this quote, relating to trust and risk, from a Belgian philosopher, Isabelle Stengers, captures how you went in to the RCA, and indeed, how many approach the design school initially?

"... the risk you might take in a new relationship with a lover or friend - you cannot foresee the outcome but you have a certain trust that can sustain its possibility. Who knows if the friendship or love will last? But we can reflect on the experience and the feelings that allow us to take risks and to experiment - the laughter and joy in the face of uncertainty..."

Paraphrased: Productive, Persistent, Intuitive, Intentional, Outdoors, Resilient



27/02/20 11:14 AM

Collaborating, Connecting, Iterating, Adapting, Experiencing

Teachers and students alike may experience a sense of freedom if they are forced to camp out in temporary spaces - if they are ejected from their silos, in other words, rather than choosing to leave them.

Being nomadic could be a brilliant way to expose design students to the 'storying of place' as Regenesis puts it. These next students can learn how to do bioregioning for real. A bioregion re-connects us with living systems, and each other, through the unique places where we live and work.

01/03/20 11:14 AM

I suppose it's not so much about venue, as the change in experience - from the physical and tangible learning in the studio, to virtual, solo physical and self-led (in terms of in-the-moment and motivation to engage fully) experiences. I think it really will feel like an ejection or rejection to staff and previous students.

Which, I agree, is brilliant and much needed. Yet for those students coming in, it'll be exactly that phrase which ever one is enjoying applying to everything in our final years, it'll be the 'how normal' - as it is a truly fascinating moment in terms of designing learning. There's a sensory and experiential element that we, as educators, perhaps haven't had to think about in terms of day-to-day learning experiences in the design school.



01/03/20 11:14 AM

"An engine of revival", what a great statement. Renewal, Regeneration, Re-imagined.

The creative tasks you've listed are something that would be interesting to map to learning paths - to chart from current design learning to those new activities, because I'm sure there are interesting routes. I've been thinking recently about the 'story' learning needs to better support a workforce and workplace of the future.



07/03/20 11:14 AM

In the renewed austerity onslaught to come, we will need to defend all kinds of public institutions - from post offices and public libraries, to community colleges and public gardens. The art will be to defend them, and transform them, at the same time. That task is best achieved by adding and deepening the relationships that connect an institution to its place.

Fig. 1-5
Extract of conversation between a participant and the author, with images as sent within the dialogue.

In the second cycle, the perspectives, experiences, knowledges (Knight, 2006) and discussions are brought into a participatory workshop setting where design and learning stakeholders question, expand, edit, connect and define dialogues to take forward. Supported to move these toward a set of written, visual or dimensional outputs, a broad range of participants are invited to create tangible dialogues, artefacts, models and systems to communicate the preferred future story. An open, public session enables sense-making (Dervin & Lauterbach, 2003) with a wider, non-disciplinary user group. This new collective knowledge feeds forward into a consolidation process with key stakeholders before producing synthesised outputs for open application and use.

Changing the Conversation

In terms of this design, the role of structuring dialogue is vital in ensuring criticality, in facilitating a space that does not impose solutions. This research activity is a piece of Design Based Research, for design learning (Collins, 1992; Brown, 1992), it forms a process that can be inserted into existing systems to frame the collection of community knowledge — through writing, making, modelling and projection. Currently in its first, iterative phase, early take-aways have included a set of guiding principles and value recommendations that inform the development of a new Creative Futures Pedagogical Framework, alongside programmes developed and delivered within the Creative Futures Academy Project at the National College of Art and Design (NCAD), Dublin, Ireland.

Conclusion

Stories evolve in both the writing and the reading, however, a story should not be confused with a fabrication, “stories mark new beginnings, pregnant with unpredictable consequences... Fabrications start with endings.” (Yelavich, 2022).

Following Escobar (2021), the present holds opportunity for significant reorientation of design theory and practice to make this a transformative moment in history. If design education has responsibility to re-imagine learning and enable new ways of shaping pedagogical knowledge (Sachetti, 2018), then it must read the future story as well as write it. This paper presents a research narrative that builds upon, and into, established theories and proposes a Design for critical, collected, community discussion, a tool that could build a repository of knowledge and restorative thinking around design learning futures, for design education. If the future does not exist, if it is uncertain, and cannot be an object of research in itself (Ollenber, 2019) then design learning must find ways to illuminate the words that visualise that future. This paper presents a critical theory work of fiction, a Design that does not justify current thinking but provides a model for building a transformative community language to script the unthought (Bardzell, 2008).

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Collaborative Learning of Ph.D. Candidates in Design on Emerging Scenarios in Scientific Publication

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Abstract

The article describes a collaborative learning process aimed at introducing early stage researchers in design to a non-hegemonic approach to design knowledge production and publications. Four co-creation sessions has been held in the context of *Prode* project, engaging phd students in design to take in account emerging issues in scientific publishing. In specific an innovative *Living publication lifecycle* has been introduced (supporting an iterative model for publications) and the relative *Living publications scenario* (including Augmented publications; Collective authoring; Evolving publications; Publications reuse) has been used to discuss and disrupt traditional publication patterns and envision beyond the “article” format, new typologies of (not only textual) research products and new forms of dissemination, to meet the challenges of an impactful design education. The context of change of scientific publication and hypothesis underlying the paper have been discussed elsewhere (Lupo, 2022; Lupo, 2023). For the purpose of this article, the focus is the training of early stage researchers, in order to make them aware of the potentiality of plurality and diversity of design knowledge publication. The collaborative approach and tools adopted eased the empowering of the PhD students through brainstorming, role plays and hands-on tests.

Keywords

Scientific publishing
Living publication lifecycle
Publication ecosystem
Co-creation methodology
Publication impact

The digital transformation and the open access paradigm (Max Planck Gesellschaft, 2003). have a considerable impact on the circulation of high-quality scientific publication at global level: in this scenario high-impact and effective scholarly communication need to be pursued with a hybrid media and content strategy, in order to get an extended impact, while maintaining rigour and authority. New trends therefore emerged (Kim et al., 2018), also questioning the oligopoly of academic publishing (Larivière, Haustein & Mongeon, 2015).

In the design domain too, these changes are asking for a deep knowledge dissemination, fostering new discourses and representations on design (i.e., “viscourses”, Bonsiepe, 2007, p.36). Hence, in the years 2020-22 the *Prode* project¹ has been carried out within the Design Dept. of Politecnico di Milano, with the aim of discussing the contexts in which scientific design knowledge is produced and made accessible (particularly in traditional academic and scientific journals) and proposing new visions and opportunities for scientific publications in the design field.

The state of art of scientific publication transformation and the leading hypothesis underlying the research have been discussed elsewhere (Lupo, 2022; Lupo, 2023) and here will be only briefly recalled.

Scholarly discourse, which was once restricted to printed texts, is now being produced in a variety of formats, including short videos, information visualisations, and networked writing: new types of journal articles (visual essays, video articles) or article elements (graphic abstract, interactive pdf), dynamic and contributive publication formats (Heller, The, & Bartling, 2014) and moreover new typologies of publishable research products (e.g. OpenAireExplore research products categories: protocols, software, data set, models...). Many open access publishing platforms and infrastructures have been established and have gained scientific recognition and reliability (Open Research Europe, 2021). According to these changes, scholars talk about the need to think of scholarly knowledge as an ecosystem (Altman & Cohen, 2022), proposing a holistic and integrated approach to scholarly communication (Birdsall et al., 2005).

In the design domain, the reflection is monitoring trends in journal expansion, in the increase and acceleration of publishing, as well as improvements in the quality of publication (Cross, 2019; Atkinson, Valentine, & Christer, 2021). Anyway, apart from more efficient editorial management systems, the patterns of scientific publishing in design are remarkably stable (Gemser, & De Bont, 2016) and the journals format, or the concept of publications, remains attached to the idea of traditional articles (Lupo, Gobbo & Lonardo, 2021). Finally, quality of perception, visual designs and reading experiences of design journals can be improved (Gemser et al., 2016; Barness & Papaelias, 2021).

We strongly believe that the design discipline can be a pivotal field for the experimentation and discussion of new scientific publication formats for scientific research.

Therefore *Prode* project started a reflection around the following hypotheses:

- 1 *Innovative forms of publication*: Envisioning and supporting innovative (e.g. augmented, enriched, interactive, contributive and collectively-authored) forms of publication, as mixed media ecosystems of content, optional and complementary to traditional linear articles. Strengthening the impact by supporting the discoverability and re-usability of knowledge beyond mere citation and critically approaching AI and content creation.
- 2 *Plurality of design publications*: Promoting choral narratives on contemporary design, for instance representing the plurality of editorial platforms, journals, initiatives, and publications from different geographies outside the mainstream.
- 3 *New models for quality and impact assessment*: Reshaping the evaluation and quality assessment of new publication forms, basing it primarily on qualitative evaluation and responsible use of quantitative indicators and by conferring the same level of academic credibility and accreditation that traditional articles receive.

Especially young researchers need to be aware and attentive of the current and emerging practices concerning scientific publications and the related issues and opportunities: therefore, with the precise intention of educating and training early stage researchers in the design field, in Nov. 2021, in the context of the *Prode* project and the course “Scientific Production”, within the Ph.D. program in Design of Politecnico di Milano, a specific module on the topic of emerging formats of scientific publication has been arranged. The module has been organized as a design-driven and collaborative model of education while engaging Ph.D. candidates in the envisioning phase of the research. In doing so, we wanted to introduce early stage researcher in design to a non-hegemonic approach to design knowledge production and publication, considering also the scientific, academic and cultural implication of new publishing formats validation (from technical, practical and legal feasibility, regarding especially assessment, reviewing procedures and copyright issues); this rethinking at the same time new educational co-created frameworks in which designer can apply their productive thinking and have an impact on collective learning systems and processes.

For the purpose of this article therefore, the focus is exclusively on the training of those early stage researchers, especially about the topic of innovative formats of publication and on the two theoretical outcomes of the research: the *Living publication lifecycle* and the relative *Living publications scenario* (described in the next section).

An Innovative Lifecycle and Ecosystem of Content for Scientific Publications: The Living Publication Scenario

The *Prode* project focused on envisioning two key concepts related to scientific articles: the publication lifecycle and the article as an “ecosystem of content”. Methodologically, case studies research and inductive reasoning have been used for exploring and envisioning new stages in the lifecycle and new scenarios of content. Mock-up, prototyping and testing have been used for the production of a beta-model of a new publishing format. This process ended up with the

proposition of the *Living publication lifecycle* and the relative *Living publications scenario*. We aim these modalities will complement the ones already in use by academic and scientific journals on a regular basis, to promote a cultural shift in scholarly and scientific publication toward open science.

The *Living Publication Lifecycle* Fig. 1 has been envisioned, from an initial case studies research (Lupo, Gobbo & Lonardo, 2021), as a circular lifecycle model, including all the stages present in the various models and inserting new ones.

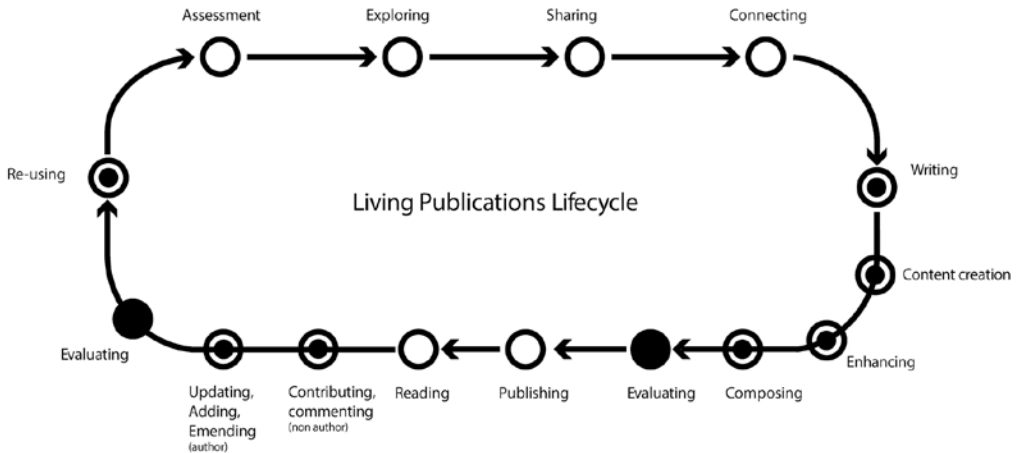


Fig. 1
The *Living publications Lifecycle*, by Authors.

The Living publication lifecycle is an iterative approach to publication, that enables in an open way the co-creation and co-contribution paradigms in the circulation, use of re-use of scientific contents. For doing this, the lifecycle stages are empowered by including new stages and innovative features and functionalities to support the shift from closed articles to multi-layered and growing publications, explaining the idea of liveability.

According to this lifecycle, a new scenario for the scientific publications has been designed as well: the *Living publications scenario*. In this scenario, open publication models allow (at the same time):

- 1 to explore in innovative and interactive way the content;
- 2 to enable flexible and dynamic writing processes, also by editing minimum discrete units of content (textual *and* non-textual) *and* by collective authoring ;
- 3 to permit to augment and enhance those content;
- 4 to reuse content;
- 5 to assess contents along all stages of the lifecycle.

Within the scenario, four specific trends, complementary each other, have been identified Fig. 2:

- Augmented publications;
- Collective authoring;
- Evolving publications;
- Publications reuse.

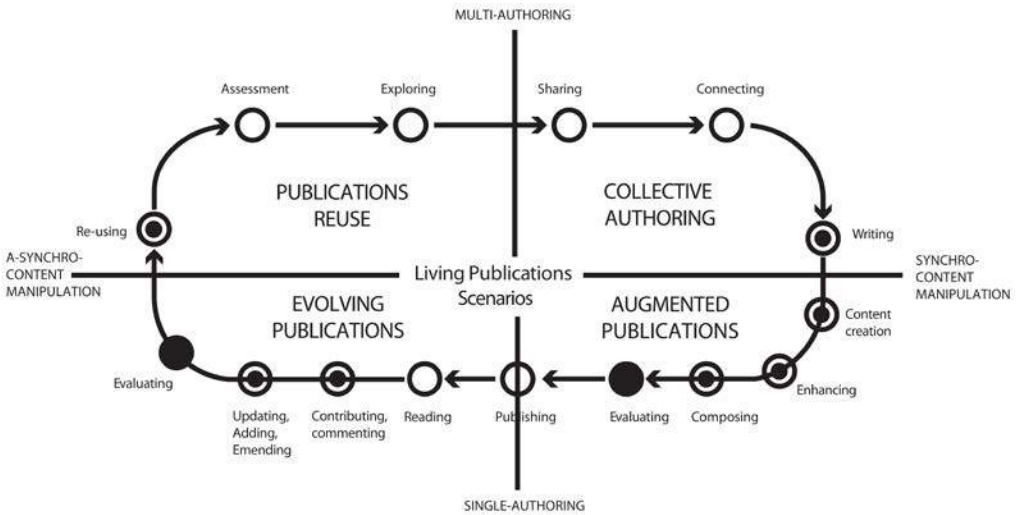


Fig. 2
The four trends of the *Living Publications Scenario*, by Authors.

The educational training proposed to the Ph.D. candidates in design, based on collaborative learning and a hands-on approach, has been focused on the experimentation of the more innovative stages of the *living publication lifecycle* of the scientific publication, and on the four emerging trends of the *Living publication Scenario*.

The four trends have been selected as the most interesting for educational purposes because they deal with publication lifecycle stages that imply an active role of the authors and a direct impact on the content manipulation.

The Augmented Publication scenario involves all those innovative practices of enriching a publication, by embedding media, visualisations, links, datasets, but also creating non-only- textual content, such as visual essays, video articles, up to articulating and structuring the final scientific publication, by creating an ecosystem of mixed media content. Relevant cases for this scenario are, beside traditional supplemental material encouraged by the most of publishers, new visual format (visual essays, visual case discussion) and above all new content ecosystem e.g., *Stanford Digital Projects* launched in 2016 by Stanford University Press or the *Journal of Artistic Research*.

The Collective Authoring scenario deals with collective authoring processes, co-authoring a publication or contributing to a non-authored publication. A relevant case for this scenario is the concept of *Open Annotation* by Hypothesis (<https://web.hypothes.is/>).

The Evolving Publication Scenario implies processes and tools to modify post-publication an authored article by scaling up discrete minimal content, adding new content data, case studies...), or updating (bibliography...), re-editing, emending (correcting mistakes...) data and content. Relevant case for this scenario are the *Evolving article* concept by Elsevier and the Dynamic Publication Formats of the Opening Science Project (Heller, The, & Bartling, 2014).

The Publication Reuse scenario deals with reusing publications content (over citation) for producing new original content ecosystems, by remixing, embedding, linking (tracking attribution and

authorship). Relevant cases for this scenario are again the Dynamic Publication Formats of the Opening Science Project (Heller, The, & Bartling, 2014) and the concept of *Supporting or contradicting citation* by Scite (<https://scite.ai/>).

Methodology. Designing Co-creation Sessions as the Educational Training for Ph.D. Candidates in Design

Focusing on these four trends of the *Living Publications Scenario*, four co-creation sessions were designed and ran with a group of ten Ph.D. candidates in Design of Politecnico di Milano, with a twofold objective:

- 1 Enabling an effective training of Ph.D. candidates on the subjects of the research, by using a design-driven and collaborative model of learning;
- 2 Incorporating into the research design process a group of people — early-stage researchers — who are among the target audiences of the research itself.

At the envisioning stage of the research, the purpose of these co-creation sessions was therefore to incorporate young researchers themselves into the design process, not just for sharing ideas and opinions, but for empowering them through brainstorms, role plays and hands-on tests, while getting them engaged around the open questions and issues related to emerging and possible future publication formats, that would arise during the sessions.

Additionally, in this specific situation, the effectiveness of the co-creation sessions was amplified, as all the participants of the co-creation sessions were early-stage researchers in the design disciplinary domain (and, furthermore, some of them were also design professionals). This circumstance made it possible to exploit the participants' disciplinary-specific creative thinking, as applied both to the development of the research design process and to the tweaking of the used design-driven and collaborative model of learning, for its possible future structured use.

Each session, lasting overall about four hours, was planned to be conducted in a hybrid mode — in person and online — and was structured in the following subsequent stages:

- A brief lecture introducing the theme of the session: 1) *Augmented publication*; 2) *Collective authoring*; 3) *Evolving publication*; and 4) *Re-using, over citation*, and the explanation of relevant related case studies.
- Round talks, a two-minutes presentation performed by each participant about a personal article they would like to work with during the session.
- “What if” activity, during which participants, divided into small groups of 2-3 students, work both on individual and other participants' articles, using a pre-set Miro board as a practical tool for collective visual annotation Fig. 3. The focus of this activity is to explore and discuss which actions authors must perform and *what* kind of contents and in which formats they have to use for augmenting, collective authoring, evolving, and re-using a publication, and *why* they should want to do so.

- Conversation starters, aimed at getting a reaction and sparking dialogue among participants, typically about the difficulties they encountered or might encounter during the previous stage.
- Guided brainstorm and final collective discussion.

Results. Execution, Evidence, and Criticalities of the Four Co-creation Sessions

The scheme described above, worked overall well for effectively engaging the participants about the general subject of the research and the topics addressed in the four sessions. In fact, from each session specific matters and critical suggestions emerged both at theoretical and practical level, also achieving the goal of involving young researchers — through these co-creative sessions — into the research design process itself.

The ideas that emerged from the four co-creation sessions, originally formulated by the participants as related only to their specific paper, have been then generalized by the authors for their possible application also to the contexts of other scientific productions.

Among the problems highlighted by the Ph.D. candidates during the co-creation session on *Augmented publication*, those considered to be most relevant, are related to “*how*”, at a practical level, it would be possible to *link, embed, compose*, etc., various media into a published and already structured article. In response to this challenge, from the guided brainstorm, emerged the possibilities of providing authors with templates with different format examples to choose from, as well as structures of contents to facilitate the composing of enhanced contents. According to participants, the main reasons “*why*” an author should be willing to augment a publication, include: having more space to put contents in short papers; having a better way to present produced content; visualizing a complex premises; making it easier for the reader to understand some concepts; giving proof of evidence through additional embedded and interactive contents to research questions, hypotheses, and outcomes.

During the second co-creation session about *Collective authoring*, the key concept of *Minimum Units of Content* emerged, defining “*what*” kind of content an author can contribute to others’ articles: an organized, standing alone, discrete unit of content that can also be reused for publication and whose authorship is recognized. This definition includes, for example, a case study discussion or a reference to literature, in which it is specified the relevance and the original idea of the contributor is clearly expressed, excluding thus, for example, a simple comment, which does not add a new layer of knowledge to the existing publication.

Within this envisioned ecosystem of publishing, comments to others’ articles are allowed in the foreseen context of an open platform model, whose users belong to an identified scientific community, in order to prevent sterile criticism, while avoiding the need of moderation.

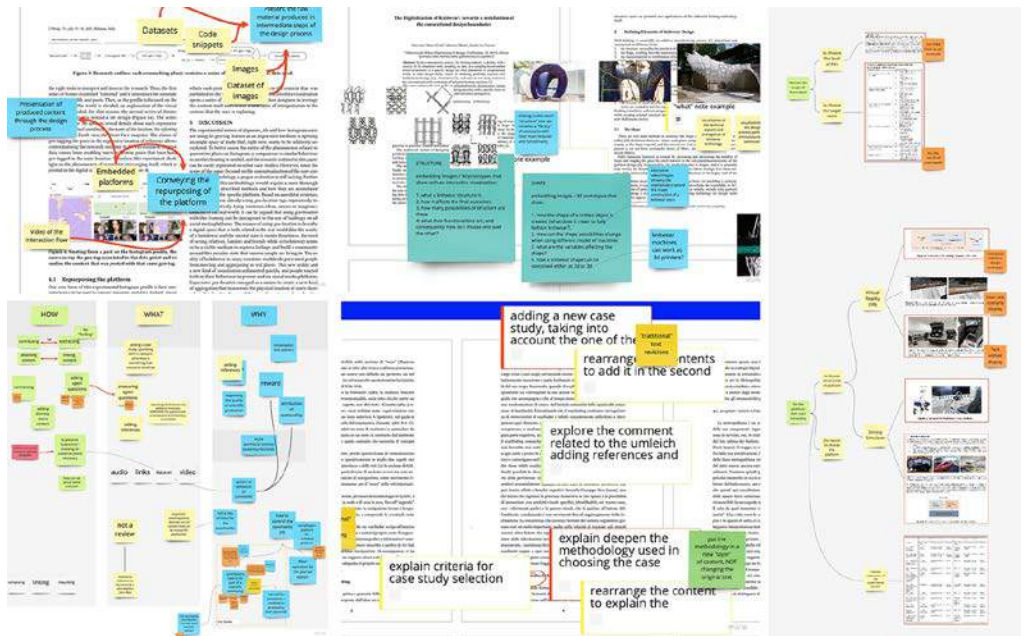
Thanks to the Ph.D. candidate feedback and insights after the *what-if* activity, during the third co-creation session on *Evolving publication*, the differences among *augmenting* and *updating* were

stressed. Though the practical tools required for performing these actions could be the same, the contexts and the reasons for doing it are different: while *augmenting* an article can occur both before and after the publication, *updating* can occur only after the publication, in order to *update, add, emend, modify, or re-edit* an article because, for example, new content is available, or peers asked for changes.

During the fourth co-creation session on *Re-using (over citation)*, the final discussion focused on the actions-phases of re-using and embedding, exploring the feasibility of some metaphors of organization of contents (maps, timelines, stories, canvas, boards...) within the concept of “remixing”, emphasizing the hint that authors should be fully aware that *composing* within this publishing ecosystem, necessarily involves making new meaning to personal and other authors pieces of contents (*Minimum Units of Content*). In this sense, most Ph.D. students argued that the architecture of contents should come from authors, and the metaphors should support it, and not influence it, leaving open the question if having a template structure could be inspiring for authors or, contrariwise, it can influence the composition of contents.

Overall, besides the specific matters that emerged from each session, the main discussed issue — transversal to the four trends of the *Living Publications Scenario* — concern the essential theme of authorship (e.g., “How is it possible to provide scientific validation to the augmented content within the current publishing system?”). The concept of *Minimum Units of Content*, which originates during the sessions, could partly address some of the open questions related to control over contents.

Fig. 3 Examples of the visual annotations made by participants on the paper used as actual case study for the session and visual annotation of the collective discussion, by Authors.



Conclusion

In this article, after briefly introducing the reasons for looking at new ways of publication in the design field and some challenges to overcome, we stressed the importance of designing innovative training formats for early stage researchers (Ph.D. candidates) on these emerging trends in scientific publication.

To answer to the challenges of this new publication scenario is beyond the scope of this article, and we provide some responses elsewhere (Lupo, 2022; Lupo, 2023; Formia, Lupo & Mehmeti, 2023). Here we presented as possible response to the specific need of training the design community in the topic, the organization and development of structured co-creation sessions within the Ph.D. program on Design of Politecnico di Milano, whose content has been based on the first outcomes in terms of case studies and scenarios of the Prode research project.

We argue that the participative format was beneficial both for the Ph.D. students and for the project advancement: the creative sessions participants' disciplinary-specific creative thinking, revealed to be effective in stimulating discussions oriented to achieving practical outcomes, which were considered in the envisioning of the living publication platform.

The research and reflection about how scientific production and publication in design is renewing and transforming to better respond and serve to the needs of the research community is ongoing in various venues (a national research group within the SID-Società Italiana di Design), a panel in the International Conference IADSR 2023, a regular call for article in *PAD journal*) in order to keep a more structured institutional dimension after the completion of the funded project.

The works concerning the design of the living publication have been advanced, starting from the design of the architecture of a web-based platform, the needed software components; the definition of the functionalities and the patterns of access and navigation within the platform, available for the different types of users; and the development of an interactive detailed mock-up (Radice, 2022). This prototype will go again under usability testing and discussion.

The overall educational aim of the project includes also the planning of other dissemination tools and seminars at national level (ongoing), and a more specific and formally structured educational training about the living publication scenario for Ph.D. candidates (planned for Oct-Nov. 2023).

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Scenarios, Networks and Systems: An Alternative to Dichotomous Patterns

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Abstract

The instability of the world's context gained prominence in the last few years with wars and pandemics. In this tricky and interconnected panorama, Strategic Design brings the possibility of reflection and action through scenarios. This essay proposes a non-dualistic way of thinking through scenarios structured by networks and complex systems and rescues the concepts of system and complexity which are sometimes forgotten by many projects. Exploratory representations of networks were generated through prototypes and by a virtual platform in order to understand their structure and the opportunities offered by their fluidity during the construction of scenarios. The concepts of strategy and complexity allow us to imagine diverse futures in a systemically way.

Keywords

Strategic design
Scenarios
Networks
Complex systems

Introduction

At the end of 2019 and in early 2020, the world faced a new, unknown, and uncertain challenge — the pandemic of COVID-19 virus. When the world believed that the battle was over, in 2022, a war broke out in Eastern Europe. A military power invades another country and threatens the world. Meanwhile, the Earth is experiencing global warming that jeopardizes humanity and the environment, thousands continue to suffer from hunger and disease in the Middle East, Africa, and Latin America.

In the face of the menaces that society lives in, the world strives to reflect on the context in the search for solutions. These solutions would be able to accommodate dissonances and deal with instability. For philosopher Edgar Morin, this crisis showed us, once again, that everything that appeared separate is inseparable and adds that an unpredictable future is in gestation nowadays (Morin, 2021, pp. 21-22). What could be a solution? A vaccine, the use of health safety equipment, or anti-missile shields? The chaos that we often face can be seen as something we minimize or as a factor of paradigmatic changes that transform our world. There are so many questions that we ask ourselves permanently because of the difficulty of imagining this unpredictable future.

Dealing with uncertainty and instability is something that often disconcerts contemporary society (Mauri, 1996). In the constant search for a way of dealing with instability and for solutions capable of accepting dissonance, the strategies construction provides a possibility for reflection and action. Strategy departs from formal forecasting — which often works with uncertainty — and directs actions in the future. Design reasoning can be at the service of building strategy's as it is used to deal with the opening of possibilities. This way of thinking is often faced with ambiguous and uncertain situations. The practice of design deals with the so-called "wicked problems" (Rittel & Webber, 1973), practical and real problems, poorly delineated, whose solutions are not given only through theories and techniques already known. Associated with this is the fact that the design process is not linear and the designer often faces some unexpected results, which Schön (1984) calls the "surprise elements".

As Deserti (2007) states, contemporary socioeconomic development is steeped in systemic complexity due to the numerous interconnected change factors, which cause rapid and unpredictable transformations. It is for this reason that, within this context, linear design models are less competent. These models do not have the ability to deal with unpredictability and uncertainty. A possible approach to deal with ill-defined problems and contexts of instability and uncertainty is the construction of design scenarios.

The scenario's goal is not to materialize itself as truth, but to stimulate decision-making and influence the present in an innovation process (Deserti, 2007). Scenarios work like a displacement in time, looking to the future to find solutions for the present. Construction of scenarios allows the visualization of possible futures through strategic conversation. This conversation brings together people with the ability to perceive, think and act. That is, the conversation allows different points of view to be brought to the situation.

The concept of future scenarios was consolidated in the second half of the twentieth century in the strategic planning field (Kahn, 1967; Schwartz, 1991; Heijden, 2005). Throughout history, human beings have always sought ways to imagine or project themselves into the future. However, events such as wars, natural catastrophes, and pandemics cannot be seen as a tapestry of time that unfolds linearly, a metaphor used by Kahn (1967). For Heijden “The idea of strategizing for the future is fundamentally based on the unpredictability of the future, of which some aspects, we assume, can be foreseen” (2005). The design field will adopt some of the fundamentals of the scenario concept through the design process. Manzini and Jégou (2000, p. 6) proposed “a more recent family of scenarios that have been defined ‘Design Orienting Scenario’ (DOS) to stress that, rather than to facilitate political decisions, they are conceived as tools to be used in the design processes”.

Design scenarios are often founded on a structure or driving forces — polarities — that guide its projections. Polarities can be seen as forces that, even at opposite extremes, attract each other. This essay aims to propose an alternative strategy to the construction of design scenarios from a systemic and non-dualistic view of the world. Imagining futures based on networks and systems seems to be an alternative to a more equitable world. A world that is presently polarized (characterized by political, religious, and geographical extremes) can benefit from systemic views of futures.

Morin assists us in better understanding the approach of scenarios. Scenarios can and must be “modified according to the information that will arrive in the course of the action and according to the surprises that will happen and disturb the action” (Morin, 2006, p. 79). For Morin (2006, p. 5), the complexity “[...] brings confusion, uncertainty, a disorder in its bosom” and embraces uncertainty as a possibility to be worked on. Complexity considers the multiple relationships, the discoveries, and the various possibilities that arise from what is unexpected. In this complex world, unity only makes sense because it has multiple facets.

The whole is made up of a complex web of relationships between its various parts (Capra, 2018, p. 40). In this context, Imagining and designing paths for better futures will require designers to be responsible for what and for whom something new is proposed. Better futures, in this article, are seen as better socio-environmental contexts for most humans and non-humans present in our ecosystem. Design should not be restricted to a small contingent of prospective methods and techniques at the risk of misunderstanding the specificity of a given project situation. The process of researching and proposing new strategies for thinking and acting in design scenarios is beneficial to this area of knowledge. It also provides designers with an ever-increasing spectrum of methodologies to speculate on future possibilities.

As part of this exploratory and qualitative research, our investigation strategy was divided into two stages. The first sought to reflect the construction of scenarios through networks represented in physical prototypes in accordance with previous research linked to three-dimensional representation (Scaletsky et al., 2015). The second one sought to work on the themes of networks and scenarios and their representations generated by the InfraNodus virtual plat-

form in order to understand the opportunities offered by the fluidity of networks during the construction of scenarios. Finally, we seek to indicate the main factors that can enhance the construction of scenarios based on networks.

Scenarios Structured From Networks

Scenarios work like a shift in time. The construction of scenarios allows the visualization of possible futures through strategic conversation by bringing together people who have the ability to perceive, think and act. This conversation allows different points of view to be brought to the situation. One of the challenges of these projection spaces is to create relevant premises or questions that can guide participants through several possibilities of diverse futures that can be described. Linear and structured methods help in the organization of data and information and provide focus on a delimited space of interaction for the project teams. These methods assist in the systemic thinking between the events that underlie the questions of these scenarios. For example, in scenario planning, there are three categories of knowledge based on the Senge iceberg metaphor (1990): events that concern what is on the surface and is visible, representing the worldview that one has. As these events relate to each other and are repeated, they result in patterns that are messages. These patterns are often called theories that will support projections into the future (Heijden, 2005). The existence of a foundational structure of the scenarios that are “submerged” becomes clear in the scenario architecture proposals Fig. 1a.

In the article “Using the concept of Rich-Prospect Browsing for conversations in design scenarios”, Scaletsky, Ruecker, and Meyer (2015) employed the structured model. This model is a three-dimensional representation in which the polarities are situated at the base of a pyramid Fig. 1b. The polarity chart organizes the scenarios as the ends of their axes represent antagonistic forces. These antagonistic forces are significant in the development of the project and that impact decision-making on future developments.

From a reflection on the figure above, it is suggested that this structure can take the form of a network or a system of networks Fig. 1c. This structure is not something rigid, but flexible and changeable. It is based on its components and on the relationships between them — which are constantly changing. When we talk about a world operated by uncertainties and rapid transformations, it makes sense that the idea of structure follows this notion and is understood as pliable and variable.

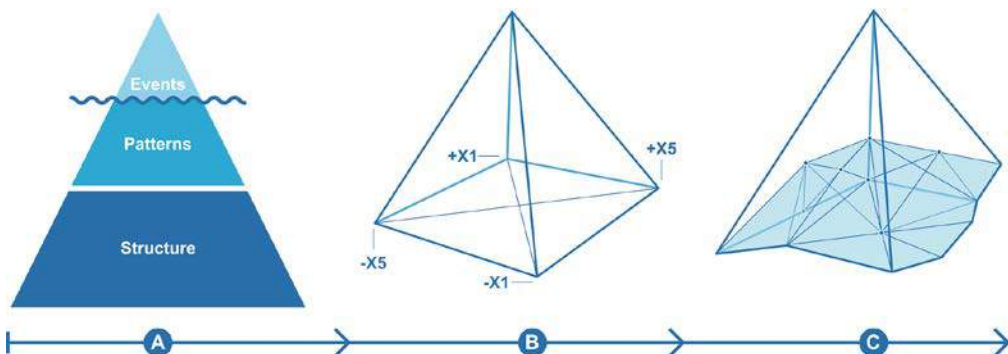


Fig. 1
Models of the three-dimensional structure of scenarios. Note. (A) Scenario planning model based on an iceberg. (B) Three-dimensional structure of scenarios based on polarities. (C) Three-dimensional structure of scenarios from a network. Chiapinotto (2020), based on Senge (1990) and Scaletsky, Ruecker, and Meyer (2015, p. 13).

By bringing systemic thinking and the idea of networks to the construction of future scenarios, we are adopting what is proposed by Castells (1996), who presents a network society in which people and organizations are connected and relate to each other through information technologies, because only the logic of functioning in a network has enough reconfiguration capacity to deal with a fluid society in constant and fast change. The author explains what he calls the “space of flows”, a space where interactions of all kinds take place, ranging from exchanges of capital, information, technology, images, etc. This space is endowed with nodes, where connections take place, and the disconnection of a network node results in physical, economic, and social ruin. Networks also have the ability to adapt to the high complexity of interactions and, therefore, flexibility is a characteristic of networks of great importance in view of the need for constant reconfiguration in a society that changes quickly (Castells, 1996).

This assumption is based on the understanding of the concepts of system and network in which Capra (2018) brings an ecological worldview, and in which the interdependence of all phenomena is recognized. For the author, in nature, there are cyclical processes on which individuals and society are part and depend on. The ecological vision is appropriate in a world where systemic, interconnected, and interdependent problems predominate because this vision considers the context in which things exist, and how these things affect and are affected by the environment. This “[...] understanding of a phenomenon within a context of a greater whole” is called systemic thinking (Capra, 2018, p.39).

In the context of a network, it is clear that the meaning of a relationship is very close to the idea of bonding. For Greimas and Courtés “A relationship can be conceived as a cognitive activity that establishes, concomitantly, both the identity and the otherness of two or more magnitudes [...]” (2016, p. 418). Identity is understood as the particular characteristics of something, and otherness is understood as what is opposed to identity and develops through contrast relations. In this definition of relationship, a possible tension can be seen within the element itself and between it and other elements. In this research, it is assumed that a system is a cluster of networks that connect and establish relationships, where the network is the organization pattern.

Systems thinking contextualizes what it seeks to understand. System properties are whole in which none of the parts exists in isolation, and these properties arise from the interactions and relationships between the parts. Each isolated part of the system is another system, thus dealing with systems within systems. This organization of the whole and the relationships between its parts can be understood from the comprehension of the concept of networks.

As in the system's logic, the "web of life" proposed by Capra is made up of entanglements, interdependent phenomena, and interrelationships in which each node is a network. In this way, the "web of life" is a network that interacts with other networks, creating network systems. Constant flows between network participants can affect the construction of visions of the future. Some properties of the network are listed by Capra (2018): a) non-linearity that is expressed in relationships that branch in all directions; b) feedback, in which everything returns to the source; c) self-regulation such as learning from mistakes, for example, d) self-organization that constitutes the core of the systemic view of life. These properties can be related to the design process as a dynamic branch of ideas in which errors occur and are part of the process of repositioning the problem and reorganizing the procedures.

Systems thinkers were interested in the organization, the relationships, and the processes that take place between the components of the system. Structure and the components themselves were not the targets of the systems thinkers. We understand the components are part of the system, and without them, the relationships could not exist.

The system follows a network pattern tending to be non-hierarchical and non-centralized. Relationships could not obey a unidirectional cause and effect logic there, but rather a relational, live, dynamic, and multiple processes. Ideas generate relationships, some of which will survive, others will disappear. This means that the process is frequently revisited. Not only is the path of building the system "built by walking", but several paths open up simultaneously and are poorly controlled (Scaletsky et al., 2021). Less control is something that differentiates the scenario concept adopted in this work, which sees this aspect as something positive and characteristic of an open design process. It is a decision-making process about different visions of the future that still must be built.

Physical and Digital Networks for Design Scenarios

With the aim of investigating the use of networks to build future scenarios, this article presents two stages of research and their results. The first part sought to build physical and three-dimensional models of networks that could help in the construction and visualization of future scenarios. Through action research, 3 workshops were held with 12 people (designers, advertisers, and journalists). The research followed resolution CNS 466.12, related to research involving human beings, and is registered with the Research Ethics Committee of the University of Vale do Rio dos Sinos, under code CAAE 14849019.8.0000.5344. Before each workshop, each participant received a "warm-up" kit Fig. 2 so that they could understand what it

Protocol analysis was performed on 6 categories identified from previous interviews carried out with specialists in scenario building, namely: Visual representation of networks and attributes; Structuring elements; Polarization through axes; Way of thinking; Fusion of the network with the scenarios; Relationships between attributes; and Materialization of scenarios.

It was clearly observed that the subjects participating in the workshops even lay people in relation to traditional methods of scenario building, tended to work with polarities, which went against the assumption of our research that sees networks as an alternative to dichotomous thinking Fig. 4.

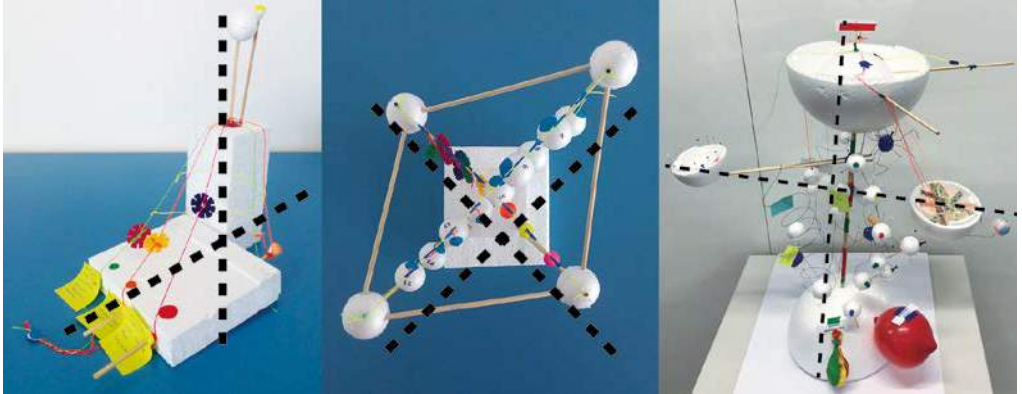


Fig. 4
Polarities identified in three-dimensional models of scenario networks. 2020. Ph. Liana Chiapi-notto.

However, the poles tended to be absorbed by the webs of constructed networks. Another significant and even expected aspect was the difficulty in breaking with cultural stereotypes associated with shapes, colors, and other qualities of objects present in three-dimensional models. Thus, the “masculine” was often associated with the square, cold and blue, as well as the feminine with curvilinear, warm, and red forms. Despite this fact, at different times it was observed that the subjects, when building networks, questioned themselves about the problematic situation, cast doubts, and criticized their own ways of seeing the world, in moments of “reflection in action” (Schön, 1984). The structuring of scenarios through networks allows moving from a vision of scenarios as a way of controlling situations to an organic and reflective way of thinking, in which the scenarios can be more focused on provocation and speculation. It is important to highlight that the different ways of thinking of the subjects reinforce that there is not only one way of building networks and scenarios. The construction of the three-dimensional network through prototyping occurred, for most subjects, intuitively, coupling the objects and connecting them to each other. The use of intuition during the design process is something recurrent and there will be times when designers will use their intuition to a greater or lesser extent. Intuition is understood as an effortless cognitive process, those thoughts that come to mind quickly, automatically, associatively, and emotionally charged (Kahneman, 2003). It was observed that this process occurred organically and the subjects stated that the prototyping of the network helped in understanding the problematic situation and in thinking about the future. It is rele-

vant to observe that not everything that the subjects affirmed actually proceeds. The fact that subjects said that the materiality of the network helped them to reflect on the problem does not mean that they really think so. On the other hand, materiality and the tactile aspect, the possibility of touching and interacting with the network were factors highlighted by several subjects, even if they were not asked. The construction of the network through prototyping rescues the ideas of Gaver (2012) and Scaletsky, Ruecker and Michura (2018), who claim that artifacts contain knowledge. This means that, during the three-dimensional construction of something, our perception of the situation can change and new knowledge can emerge from what is being developed. It was noticed that the network, as an artifact, allows the construction of narratives — assist in the construction of a scenario — or it can be the narrative itself — the scenario Fig. 5.



Fig. 5
Network considered as
a scenario by workshop
participants. 2020. Ph.
Liana Chiapinotto.

This merging of the network with the scenario reinforces the theory that states the more interrelationships between the network attributes, the more difficult it becomes to undo it. It should be noted that it is not an objective of this research to untangle the network, as this would be a reductionist path, it would reduce the complexity by isolating the parts of the network. Furthermore, Capra (2018) states that the network nodes are integrated into the functioning of the whole and this notion is reiterated by Castells (1996) when he says that the disconnection of a network node represents the end of this node. The network, as an interrelated and flexible whole, allows an integrated view of the scenario-building process, in which there is no division into stages. The prototype of a network is something material, it has its own attributes and, in this sense, one must take into account the intangible aspects that are part of the creation process, of the imagination of the subjects who are building them. It is understood that these intangible aspects are connected with the way of thinking about each subject. The way of thinking concerns the way subjects break the linearity of their reasoning, reflects on the prob-

lem, interprets the situation and the attributes linked to it, and how they think about the network and the scenarios. Last but not least, it was noted that the network's prototyping activity reinforces this ludic aspect of scenario building, and the ludic must not be confused with something superficial and frivolous.

This stage of the research sought to investigate the role of networks translated into physical prototypes in the construction of the scenarios. The second stage sought to observe the representation of virtual networks in the scenario construction. As always in our research, it is not a question of choosing between one way or another but offering new ways of thinking about complementary scenarios.

In this second stage of the research, we opted for action research, holding 5 workshops and a protocol analysis. A total of 13 professionals participated, chosen according to the convenience, contact network of the researchers, and by the snowball method (new participants recommended other contacts interested in contributing to the research). The research also followed CNS resolution 466.12, related to research involving human beings, and is registered with the Research Ethics Committee of the University of Vale do Rio dos Sinos (Unisinos) under code 43806621.0.0000.5344. The workshops, due to the distancing measures suggested by the World Health Organization, were held online via the Google Meet videoconferencing platform and with the Miro collaboration tool. Unlike the first stage of the research, each workshop defined its theme that would be used in the construction of scenarios from the visualization of networks generated on the InfraNodus platform, without interference from the researchers. The themes were: (i) the COVID-19 pandemic; (ii) the future of tourism in Brazil; (iii) conversational-commerce platforms; (iv) retail, fashion, and loyalty in the face of omnichannel; (v) social networks, fake news, and elections; and (vi) workshop, when everyone does a workshop.

An important aspect to point out is that this research was not interested in getting into the intimacy of the platform and understanding how the algorithm generated the networks. This would be a topic for another (important) research. We are just trying to understand how something generated by a platform may or may not help in the construction of future scenarios.

The semantic construction process in the InfraNodus platform, applied in this essay, consists of different phases and with the assistance of different algorithm processes: first, all words are converted to lemmas in order to reduce redundancy and group different variations of the same word. Then, automatic removal of stop words is performed, which only works as a link and does not carry any additional meaning, such as: and, or, if. The text is converted into a network graph and a classification algorithm is applied to identify the nodes (words) with the highest betweenness centrality. Words that appear most frequently tend to be central and may contain the junction of different meanings within the text. Then, a second community detection algorithm is applied, trying to create topic clusters.

Finally, a third algorithm is applied that aligns the most connected clusters and pushes the nodes apart so that the visual reading of the graph can be performed more easily and intuitively. With the structure defined, the graph is presented with the colors and topology pointing to different topics present in the text.

The network serves as an analogy for visualizing and debating the world. In some cases, in the field of computer science, statistical analyzes are performed on the object. In this case, a visual and interactive analysis with the aim of dialogue in order to stimulate subjectivity in the construction of future scenarios. We must say networks do not point straight to the future but serve as fuel for imaginative thinking.

It was observed that the visualization of networks makes it possible to translate the structural complexity of a problem through interactive exploration between the present actors. The need pointed out by Jacomy (2021), when referencing Donna Haraway (2009), to situate and explore the commitments of networks as they depart from a particular place, should be highlighted. We warn that the visualization of a network is not used simply as a visual curiosity. The ability to modify visual information on the network with the help of platforms is an emerging competence to be developed by the field. The relationship between scenario and network is not uniform and can be observed from different influences. In some cases, a certain centralizing relationship between the nodes impacted the construction of a future narrative. In others, a peripheral influence, whose dispersed elements in the network guide the narrative and the absence of an expected element in the network, provoked a reflection on a certain theme. Visual analysis of networks affected the construction of scenarios both by the presence and absence of a certain topic in the network: sometimes, participants used the centralizing nodes that have a greater competition to speculate about the future. In other, the participants selected a node in a more peripheral position to abstract the theme. There were situations in which new elements that were not present emerged from the participants' prior knowledge and influenced the orientation of future visions. At that moment, the subject interferes and modifies the received network. Projection in time was an element observed in a different way between scenarios and networks: it was observed that in scenarios there is a greater propensity for imaginative thinking that can catalyze and redefine a problematic situation, aiming not at the pursuit of a future, but at its various possibilities. Visual analysis of the networks is capable of projecting past and current events that subjectively influenced the construction of scenarios. The network cannot be considered the only element in the orientation of the scenarios and proved to be a mediating component of other methodologies, such as contextual data research and polarity maps.

To exemplify the representation of a scenario from network dynamics, see Fig. 6.

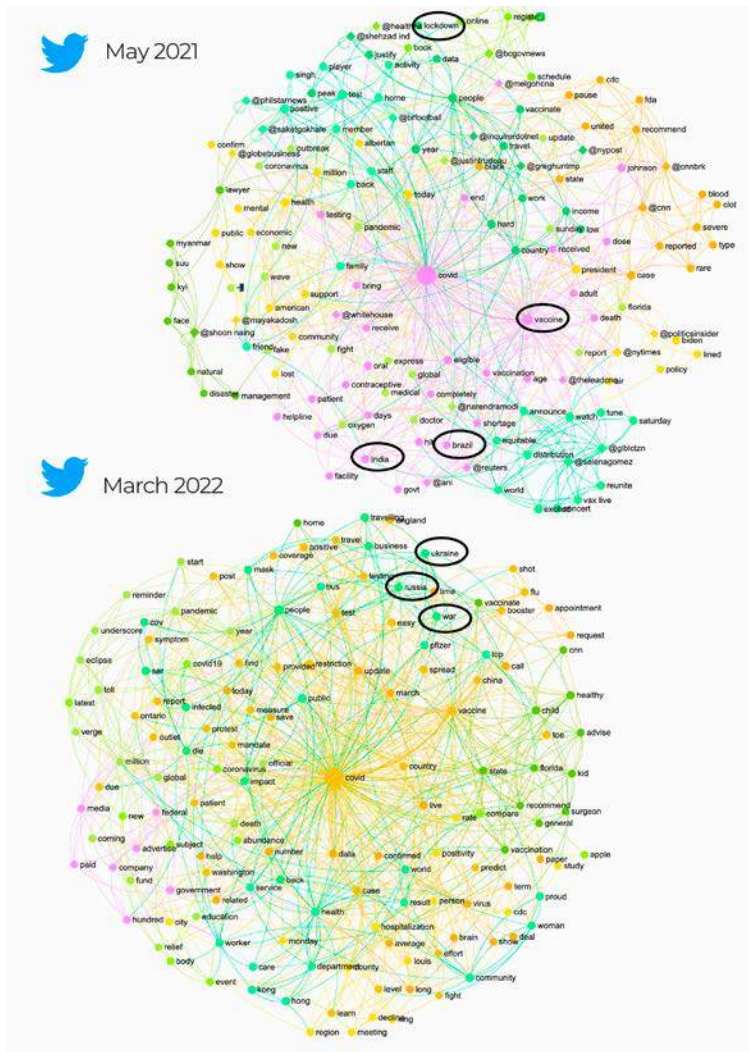


Fig. 6
Networks scenarios
representation, by the
authors.

Final Considerations

Networks, constructed in the two stages of this research show that events change all the time and the assimilation of the network concept can act in the transformation of the designer's way of knowing, making this person more fluid and sensitive to changes. Understanding that everything is interconnected can and should impact perceptions and theories about what the future may be. Futures based on networks might represent a more attentive process with the dynamics of events and, in this sense, a situated, reflective, and inserted projection into action.

The choice of visual analysis of networks was based on the assumption that visual practice is an entry point to generate engagement with the universe of visualization, network analysis, and scenario building. The visual character present in the analysis and visu-

alization of data as well as three-dimensional models comes from the impetus to structure what is not structured. Scenarios and networks had the potential to decode (and not to reduce) the structural complexity of the current issues discussed. Thus, it is believed that these two ways of building networks can be incorporated as strategies within the scenario practices, contributing to more designers using technologies as a facilitator to explore and visualize data.

The two research stages differed in relation to the production of networks. While in the first the actors created the networks in a three-dimensional and physical way, in the second stage of the research the networks were generated by a system and represented in a two-dimensional form. This did not prevent the networks worked from serving in both cases as a means of conversation, imagination, and stimulus to the appearance of surprises, of elements not imagined at the beginning of the process.

Another observed difference refers to the playful aspect highly present in the construction of three-dimensional physical models, which appeared in a less eloquent way in the second stage of the research. This fact may be related to the platform used and the pandemic context that prevailed in this second moment of the research.

At various moments during the activities, elements emerged that were not part of the initial intentions of the researchers, and this is an aspect that reinforces the idea of what a new way of building scenarios could be. This appearance of unexpected elements, not planned by researchers, is a positive aspect of the whole process, as it shows that the construction of scenarios can be as organic as a network.

In the physical networks, the overlapping of the networks with the scenarios was stronger. The network was the scenario. In the second stage, the networks were, obviously, closer to the problematic context studied.

For the construction of Design scenarios, in the 21st century, it seems not enough to think based only on dualities. How is it possible to imagine that there is a leader of a great nation in Eastern Europe acring in isolation and without connection with the various economic interests of the East, the West, the South, and the North?

All the elements of this network behave in an articulated way, some influencing and being influenced by others. The very elements and relationships of networks are transformed. There are no absolute truths. The system is transformed with each project movement, and a simplistic and reductionist view, as in the view of polarities, does not seem to support any imaginative, creative, and consistent exercise of future worlds.

This essay starts with a critique that is based on the professional and academic experiences of its authors. Criticism refers to the frequent loss of the concept of a system. The strong Modern tradition of the 20th century still manifests itself in fragmented and reductive constructions of imagined systems. The authors of this article take a different view of the system, based on the complexity and network relationships between the actors that participate in a product-service system. Thus, the rescue of some fundamental concepts of system and complexity seems to be a good way to enhance the design scenario concept.

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Strategic concepts for the field by this investigation expand the ways in which design teaches and thinks scenarios, beyond prospective methods that stimulate speculation by antagonisms. Network elements allow us to imagine the future and reflect on the past and present in a systemic way, with the density and specificity that are required from the design professional in problematic situations.

Design is an area of knowledge of a creative and inventive nature that is concerned with the transformation of its environment. It is important that research in the area increasingly provides methodological resources to designers that stimulate and/or teach them to articulate procedurally a complexity of references that correspond to the complex nature of the relationships that permeate our way of being in the world.

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The 8th International Forum of Design as a Process, themed “Disrupting Geographies in the Design World” was held in Bologna from 20 to 22 June 2022. The event was organised by the Advanced Design Unit of the Alma Mater Studiorum – Università di Bologna, Department of Architecture, in collaboration with two partner universities: Tecnológico de Monterrey (TEC) and Pontificia Universidad Católica de Chile.

The Forum engaged speakers from the Global Design community, expanding the original vocation of the Latin Network for the Development of Design as a Process to include researchers and designers of the Mediterranean Area, Middle East, IOR (Indian Ocean Region), and Global South regions. The goal was to share new perspectives on imagining design futures in a responsible and just perspective, at the forefront of change, while building strategic partnerships and creating accessible knowledge.

Structured around three pillars — seminars, workshops, and exhibitions — the Forum hosted meetings, reflection opportunities, networking activities. It involved designers, scholars, young researchers, design entrepreneurs, in an experimental format.

Speakers’ contributions not only inspired the practices of the designers’ community, but also resonated with students and the broad audiences. The presentations explored intersections of materiality and culture, post-coloniality, decoloniality, gender studies, and other areas of human thought and action which seek to analyse, question and challenge the disruptive geographies in the world, today.

The papers submitted to the five tracks proposed are published in the Digital Special Issue 1 of *diid. disegno industriale – industrial design*, celebrating during those days its 20th anniversary and serving as the fourth partner of the event.

The Editors

Erik Ciravegna, Elena Formia, Valentina Gianfrate,
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