

ADVANCEMENTS IN DESIGN RESEARCH

11 PhD theses on Design as we do in POLIMI



edited by Lucia Rampino and Ilaria Mariani



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Over the last few years the international design research network has become an important reality, which has facilitated the sharing of ideas and opinions, improved understanding of the subject and increased awareness of the potential of design in various socio-geographical contexts.

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The Design International series is thus born as a cultural setting for the sharing of ideas and experiences from the different fields of design, a place in which you can discover the wealth and variety of design research, where different hypotheses and different answers present themselves, in an attempt to draw up a map of Italian design, though in a continuous comparison with the world scene.

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DESIGN INTERNATIONAL

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The evolving boundaries of design research at Polimi: education, soft skills, creative companies and digital tech

Lucia Rampino and Ilaria Mariani
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Twenty years have passed since October 1998, when the first conference on doctoral education in design was held. Organized at Ohio State University, it brought together participants from a number of countries. Among them, Ezio Manzini, then Coordinator of the Politecnico di Milano PhD Programme in “Industrial Design and Visual Communication”.

On the occasion of that seminal conference, Buchanan, then Director of The School of Design at Carnegie Mellon University, envisioned doctoral education in design as a “neoteric enterprise” (Margolin, 2010). In Buchanan’s own words, the objective of neoteric education was to “gather resources from any area of previous learning in order to find new ways of addressing the new problems, thereby creating a new body of learning and knowledge” (Buchanan, 1999, pp. 6-7). Twenty years after, these words can still be shared: the *new problems* affecting our globalised, bewildered and worried society are growing in numbers and in complexity, and *new ways* of addressing them are more sought-after than ever.

First established in 1990, in 1998 – at the time of the above mentioned conference – the Politecnico di Milano Doctoral Programme in “Industrial Design and Visual Communication” was still affected by the traditional legacy of the design discipline, being mainly concerned with the relations between tridimensional and bidimensional artefacts and their users. In the following years, the spectrum of the research issues addressed by the doctoral candidates has widened, so to embrace not just the system of material objects, but also the relationships between production networks and social systems, up to urban areas and the environment. What should be noted, in this broadening of topics, is the constant reinforcement of themes related to both the development of cultural and environmental assets and the enhancement of local identity and productions, matters typical of the Italian context (Bertola

and Maffei, 2008). To testify this enlarged disciplinary focus, in 2009 the name of the Doctoral Programme was changed into “PhD Programme in Design”.

Today, twenty-eight years after its first establishment, it might be said that the perspective of the Politecnico PhD Programme has undergone a process of zooming out, from a focus restricted to the product itself, to a wider focus also including users, to an even wider one taking into consideration a system of interconnected digital products and stakeholders, and finally to one which embraces society as a whole (Rampino, 2018).

The PhD Book Series and the PhD Festival

The present book is part of a series that documents the production of the Politecnico di Milano Design Programme, presenting a detailed summary of the doctoral theses defended each year (Biamonti and Guerrini, 2017; Guerrini, Biamonti and Mariani, 2018), as well as of the design discourses that are nodal in the field (Guerrini and Volonté, 2018).

To promote participation and nurture debate, in 2010 the defence itself turned into a public event where candidates present and discuss their thesis in front of a varied community composed of master students, peers (designers and researchers), as well as a committee of international scholars (panel of discussants). The social dimension of the event is emphasized by its being shaped as a “Festival”, that is to say a space and time where to celebrate and share knowledge, promoting conversations on design and design research. At the core of the Festival lies the intent to address a persistent and long standing weakness of the design discipline (Buchanan, 1992), namely the difficulty in activating constructive discussions and effective knowledge exchange between practitioners and researchers from one side, and among different design academic communities on the other. The aim of the PhD Festival, which explores design research both during the “formal” defence of the doctoral theses and the “informal” talks given by the members of the panels of discussants (the so called “design pills”), is to leverage diversity and interconnections and to reflect on the broad nature of design and its relationship with other disciplines.

More in specific, this book presents the outcomes of the doctoral research carried out by eleven PhD candidates who completed their three-year commitment and are discussing their thesis early in 2019, on the occasion of the 9th edition of the PhD Design Festival. What emerges is a complex picture wherein several fields are investigated, covering multiple aspects of design

research: education in spatial and fashion design, soft skills and collaborative processes, cultural and creative industries, data visualization, DIY-Materials, the revitalization of urban spaces. Eluding reduction, design research persists in exploring meanings, implications and hybridisations that feed itself. Indeed, as Buchanan (2001) noted, designers are continually inventing new subject matter; thus, it is not possible to limit the investigation of design to a fixed set of material or immaterial artefacts.

Such diversity is also nurtured by the wide spectrum of disciplines covered by the backgrounds of both Polimi research supervisors and PhD candidates, ranging from architecture to design, from art history to mechanical and chemical engineering. Since design facilitates encounters and networking, dialogues and conversations (Guerrini and Volonté, 2018), the Doctoral Programme in Design at Polimi looks at disciplinary overlapping as an added value and a source of benefit.

In the variety of researched topics, a common trait can be found in the continuous need of updated ways of addressing complex problems, as already mentioned above. It is such need that drives the evolving boundaries of design research forward, not just within our Doctoral Programme, but within all the national and international Doctoral Programmes in Design we are acquainted with.

Eleven theses, two categories, four fields of investigation

The presented eleven doctoral theses reach out to different design fields and research categories, exploring current and potential relationships among design, art and engineering. In this respect, it has to be said that even if the book does not cover the whole range of topics currently investigated within the Polimi Doctoral Programme in Design, it provides a distinctly established overview of some of our areas of interest as well as a viewpoint on our way of conducting research. Each essay is the result of a three-years doctoral work that stemmed from specific research assumptions and then framed its own design questions and objectives.

Analysing the outcome of each dissertation, it is possible to subdivide the eleven theses into the following two categories (Bertola and Maffei, 2008):

- **theoretical research**, i.e. dissertations with a prevalently theoretical slant, the outcome of which implicates the construction of new conceptual tools. In this first category we can find the large majority

of this year dissertations, eight out of eleven. We are referring to the dissertations by the following PhD candidates: De Rosa, Lin, Valušytė, De Vecchi, Tiburcio, Braga, Colombo and Ayala-Garcia.

- **instrumental research**, where research is mainly into design related methods and approaches. In this category, we include the remaining three dissertations. The outcome of the first one, by Motta, is a teaching tool for fashion design. The second one, by Testa, proposes a set of design tools for multidisciplinary teams. In the last one, Briones developed a research tool, i.e. a taxonomy for exploring the visual representation of data-driven narratives.

Focusing instead on the topics covered by the PhD candidates, the volume is structured into four sections gathering the eleven essays around the following fields of investigation: Design Education; Collaborative Processes; Cultural and Creative Companies; Technology for Social Change.

In general, it should be noted that three out of eleven theses deal with Fashion Design. This should not come as a surprise, being the Fashion Industry a pillar of the Made in Italy and of Milan, one of the Fashion capital at an international level.

Under the topic **Design Education**, three dissertations are gathered: the first one investigates the possibility to match spatial and service design in a novel framework useful to educate a new breed of designers. The second one deals with the urgent need of internationalization of the fashion design curriculum. The third one deals as well with fashion design education, with a specific focus on knitwear design.

When it comes to **Collaborative Processes**, three dissertations open up quite different yet related points of view. In a nutshell, all of them explore how design relates to and nurtures soft skills, each dissertation with a specific aim: the first one aims to educating non-designers; the second one to facilitating the setup of empathic experiences; the last one to giving rise to participative processes for urban renewal.

The third field deals with use of design-driven innovation as it is nowadays a recognized competitive lever for **Cultural and Creative Companies**. Two dissertations cover this topic, one focusing on the Brazilian manufacturing system, the other on the Italian Fashion Industry.

The fourth field of investigation is concerned with the impact of **Digital Technologies**. Under this topic, the last three dissertations are gathered, all of them analysing this phenomenon from a social perspective that complies well with the design discipline.

The first dissertation enquires how data and their visualization can contribute to our knowledge as well as to collective activism. The second one envisions experiences, strategies and possibilities in urban spaces and smart cities. The last one analyzes the emerging phenomenon of DIY-Materials.

Hereafter, a brief summary of each essay is presented.

Perspectives in Design Education

In *Dialogues on the relationship between Spatial and Service Design*, Annalinda De Rosa explores the relationship between Spatial Design and Service Design. Her aim is to carry out a first step towards an approach defined as Service+Spatial (S+S) Design: the thesis is a foundational act in this direction. The study looks at the topic employing and intertwining a twofold viewpoint: a design perspective and a design culture background. The aim is to move towards transdisciplinarity contributing to expand the knowledge on Spatial Design, an research field still little explored when it comes to Service Design.

In *Internationalizing the Fashion Design Curriculum: Nurturing Internationalized Talents*, Xiaozhu Lin explores the practice of curriculum internationalization within and across the discipline of fashion design. In parallel to this critical analysis, the author identifies strategies to internationalize the fashion design curriculum, as well as possible improvements and potential adjustments to be implemented in order to improve the programme. As such, the practical results are intended to offer a valuable reference to other design educators to explore the theory and practice of curriculum internationalization.

In *Designing Knit Designers. Teaching tools and methods to train professionals for the knitwear industry*, Martina Motta focuses on Italian knitwear both as an industrial excellence and as a design discipline taught inside design universities. Her aim is to experiment new ways to support Small and Medium Enterprises to answer their concrete needs in terms of young professionals. The research acts with experimental activities towards the definition of tools and methods to train professionals able to respond to the needs of the industrial context, with the proper technical and cultural knowledge and the project-oriented mind-set typical of industrial design disciplines.

Collaborative Processes Enabled by Design

In *Design as enabling agent. Design culture and non-designers in the changing role of disciplines*, Rūta Valušytė argues that design-related skill-sets are the most relevant for dealing with complexity and rapid change. Three skill-sets are associated to design: (1) Design Thinking skills; (2) Thinking Wrong personal qualities; (3) Future Thinking Principles, all together in this research labeled as Future Personal Characteristics – FPC’s. Valušytė’s research investigates the primary assumption that D-culture experience can influence non-designers in developing FPC’s.

In *Designing the empathic experience. Suggestions from art practices*, Alice Devecchi builds a theoretical framework from a phenomenological account of empathy, focused on empathy’s nature of interpersonal experience introducing the other into one’s own personal horizon and enabling the acknowledgment of otherness. Her cross-disciplinary work waves philosophy and art into the current design discourse, trying to translate theoretical reflections about empathy and our modes of experiencing the other into guidelines for facilitating collaborative processes and managing the relational dynamics at stake therein.

In *Intermediate urban space. Design and light art as catalysts for change: participation beyond fruition*, Isa Helena Tibúrcio aims to inspire the production of interventions in the urban space, which can, simultaneously, be closer to people’s needs and offer aesthetic experiences. The main contribution of her research is to move the focus of ordinary people from fruition to participation into the conception phase of the design process. A second contribution is to discuss the concept of “intermediate urban space”, matching the physical and symbolic aspects into one concept related to the space of the urban experience.

Design for Cultural and Creative Companies

In *Handling the Complexity of Design Support Programmes*, Mariana Fonseca Braga and her supervisor, Francesco Zurlo, analyse design support programmes that aim at introducing design innovation into Micro, Small and Medium-sized Enterprises with little or no design experience in Brazilian traditional industries. The analysis showed that barriers and drivers differ according to: (1) the context in which each project is embedded, including the

economic and political priorities and orientation, as well as cultural aspects; (2) the way programmes and their projects are crafted, managed, implemented, and evaluated; (3) the background and mindset of key stakeholders who take part in these projects.

In *FashionTech: Interaction Across Boundaries. Integration practices for design-enhanced user experiences*, Susanna Testa identifies the tools that are necessary to streamline the design process of fashion products with embedded technology. The outcome is a methodological proposal and a tool for integration-based design. This approach permits to highlight the need to train professionals who may play a cross-cutting role in the integration process between the disciplines and the actors involved.

Design and Technology for Social Change

In *A taxonomy of data visualization projects for alternative narratives*, Maria De Los Angeles Briones states that data visualization for data activism must disclose its design process in order to communicate not only visual evidence but also the construction of such evidence. Therefore, she designed a taxonomy aimed to organize the exploration of cases. Her taxonomy is not intended to impose a single classification, but to be a starting point for exploring the visual representation of data-driven alternative narratives.

In *Studying digital images in groups: the folder of images* Gabriele Colombo proposes the use of digital images available online as a source for the study of collective phenomena. He discusses four features of digital images to make the case for the shift from the individual image to the group of images (i.e. the folder of images) as main unit of analysis. The four features are: volume, images as data, networked nature, blurriness. As a conclusion, he argues for the design of tailored interfaces for the study of images in groups.

In *The Materials Generation*, Camilo Ayala-Garcia and his supervisor, Valentina Rognoli, present a research conducted to understand the DIY-Materials phenomenon as one of the emerging materials experiences in the field of design. The essays shows the formulation of research questions and hypotheses, the qualitative methods and strategies applied to conduct a number of tests, and the way in which the gathered evidences are drawn together in an attempt to clearly define this phenomenon.

As a conclusion, we want to recall the following statement by Victor Margolin:

As the artificial world continues to expand in its relation to nature, design is too important a subject to be ignored. We humans are the stewards of this artificial world just as we are responsible for the natural one. Only by preparing ourselves to manage an increasingly complex natural and social environment in which design plays an ever more important role will we be able to fulfill our duty as good stewards. Well-conceived and highly focused doctoral programs in design are central to this task.

(Margolin, 2010, p.78).

Such claim, written by one of the leading scholar in Design Research, appears to be particularly appropriate to finish our reasoning aimed at introducing the eleven essays collected in the present book.

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We need new steps

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In Japan exists an extremely magic word: *ikigai*. The meaning of *ikigai*, as often happens with Japanese terms, is not so easy to explain and neither directly translatable. It's more a concept than a simple term. A concept that deals with different areas of existence.

First of all it has to do with “what we Love”, indeed probably the most not-rational portions of our life. A land where we could follow some intuitive, sometime instinctive, invisible path, toward an undefined final destination. A deeply emotional portion of our existence, in which we could experience the overlapping of Passion and Mission.

Ikigai has also to do with our skills, or with “what we are good at”. As the motto of the watchmaker Alain Silberstein was “*le vrai bonheur, est d'avoir sa passion pour métier*”, that means, for the luckiest people, to talk about the crossing between their Passion and their Profession.

We're use to perceive the professional dimension of our life connected with an economical dimension. So we're talking about “what we can be paid for”, the kind of activities we exchange with money. That means of course that somebody appreciate what we do, and pay for it. The best condition it would happen when the characteristic of our Profession meet the one of our Vocation.

But as we're not alone in our life, the fourth concept of *ikigai* deal with our contribution to “what the world needs”. We have a social dimension and each one of us could have a role in the world, especially if we could find a good balance between our Vocation and our Mission.

The term *ikigai* is explained with a circular diagram, in which we could see a magic balance between the most private and emotional dimensions and the pragmatic and social ones.

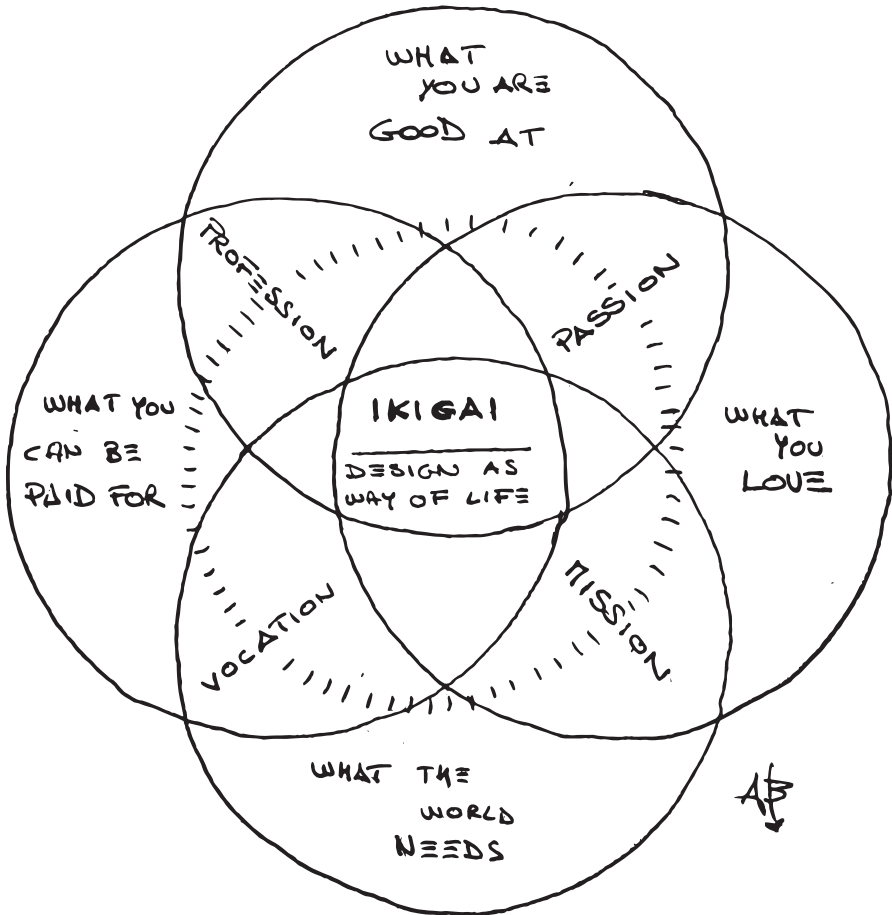


Fig. 1 – Relating Ikigai and design as a way of life.

Looking at the diagram, I could not stop to turn my eyes between the four central words – Passion, Mission, Vocation and Profession – and to put them in relation with what I think is the goal of Design: producing a new portion of experience, tangible or intangible, which contributes to make a better world.

Probably the *ikigai*'s diagram could be a good way to represent the Ettore Sottsass's thought "in Italy, design is not a profession, it's a way of life". In fact, it represents an extreme synthesis of a professional approach that involves emotional and professional aspect of our life, in a sort of mission for a better world, starting from small portion of everyday life, as object, colours, spaces. A professional approach for which technical skills and knowledge

are important, but not enough. Not enough to embrace such wider cultural, emotional, technical and professional dimension of life.

Design, as human activity, has very ancient roots, ancient as human history. The first cave's graffiti, the stone arrows, the wheel, the fire and how to use it... all are design actions, with the goal of improving the everyday life experience. Since the very beginning of the human production, in terms of signs and artefacts, we could appreciate how the technical dimension has not been the only one to take in consideration.

The relation between artefacts and human beings is indeed usually extremely more rich than the simple technical performance of what artefacts could "do". We need a technical performance, it's clear, but that should be a base on which we build a more intense relation, involving the emotional apparatus of human beings.

Nowadays we're living in an era in which intangible interaction and new form of production are deeply changing our everyday material and relational landscapes. A scenario in which design is everywhere, even if often it's hidden. Looking at that scenario using design parameters of last centuries is like trying to switch on an iPhone with a medieval iron key...

We probably need to do two kind of steps. First we need a step back. A step back to our ancient history, to explore the careful balance some very ancient artefacts transmit us through centuries. But that exploration of the past has to be just the run-up for a big jump. We need probably to jump in a new era in which we define new reading keys and parameters for a new mature cultural and anthropological dimensions of Design.

Perspectives in Design Education

Dialogues on the relationship between Spatial and Service Design

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Abstract

The central topic of this study is to identify dialogues on the relationship between Spatial Design (SpD) and Service Design (SD), exploring their disciplinary implications in a theoretical analysis of specific areas of the research landscape through design. The aim is to take a first step towards an approach defined as Service+Spatial (S+S) Design, and the doctoral thesis by the author is a foundational act in this direction. The topic has been studied from a design perspective and from a design culture background in order to attempt a first contribution towards transdisciplinarity¹, in order to expand on an unexplored gateway into SD, that of SpD. In this contribution, however, the author illustrates only a specific part of the theoretical discourse elaborated, through two “dialogues”. These are meant to explore a wide range of theories and aspects of design that are necessary for the foundational shift towards transdisciplinarity between SpD and SD. The Dialogues act as inter-

¹ The notion of *trans-disciplinarity* is based on the hierarchy of increasing complexity from multi-, cross- to inter- and trans-disciplinarity in the cooperation and coordination among disciplines as discussed by Erich Jantsch in his seminal work published in 1972: *Technological planning and social futures*. New York, NY: Halsted Press. Also: Gustafsson, A. *et al.* (2016). Developing service research-paving the way to transdisciplinary research. *Journal of Service Management*, 27(1), 9-20; Edelholt, H., and Löwgren, J. (2003). Industrial design in a post-industrial society: A framework for understanding the relationship between industrial design and interaction design. In *Proceedings of the 5th Conference of the European Academy of Design, Barcelona*; Muratovski, G. (2015). *Research for Designers: A Guide to Methods and Practice*. London, UK: SAGE. Celaschi, F., Lupo, E., and Formia, E.M. (2012). From trans-disciplinary to “undisciplined” design learning: educating through/to disruption. In *Third International Forum of Design as a Process*. Torino, Italy: Allemandi.

nal conversations about converging factors across the disciplines to identify an effective “conversation”. They represent the scope of creating supportive structures between SpD and SD, meaning the disclosure of the fundamentals of an S+S design to reconsider the tangibility and intangibility of SD through a spatial perspective.

Introduction

Over the last twenty years, SD has become more and more defined: building its specific approaches and methods; understanding its boundaries and mutual connections with other disciplines (i.e. management, marketing innovation, service science, social/behavioural science, computing and engineering, industrial design, etc.); and being itself an already structured methodology. Furthermore, SD received contributions in its definition from those disciplines, as well as from the design tradition, where it has been explored in the branches of strategic design, design for sustainability and interaction design. It is important to clarify that this study is based on a design background: “service design is concerned with systematically applying design methods and principles to the design of services” (Holmlid and Evenson, 2008, p. 341). In fact, service science in turn built its origins on different streams (Mager, 2008), being an interdisciplinary area of research of its own right. The “spatial” component has been implied within theories and practices when exploring services with physical evidence, but without an in-depth analysis of a direct dialogue in research through design, between the scientific communities involved. There is a lack of research on the languages, theories and methods linking them.

These observations hint at new potential scenarios in which to design the unfolding of services in physical spaces and open the doors to exploration into this gap of knowledge.

Framing the research

*Service innovations are reshaping spatial experiences.
Spaces are a part of the service system to be designed.*

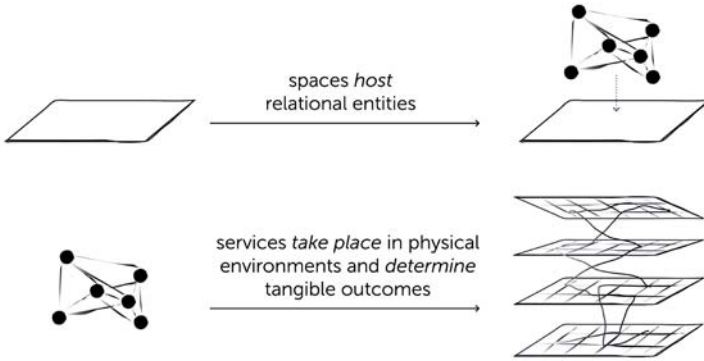


Fig. 1 – Diagram by the author representing the initial and fundamental assumptions of the research presented.

The study originates from the perception that services are influencing and identifying spaces, and new uses thereof: SpD encounters SD in urban planning, and in the design of workplaces, retail settings, private interior spaces, public services and infrastructures. In this range of settings, spaces *host* relational entities and vice-versa, services *take place* in physical environments and *determine* tangible outcomes.

Yet, despite the strategic importance of the theme, demonstrated by S+S experimentations in design university courses² and in design practices³, the

² I.e. 1) the programme in “Interior & Service Design” (final year of the Bachelor and post-graduate year of specialisation) at the Thomas More University College in Mechelen (Belgium); 2) the Master’s programme in Product and Spatial Design at the Aalto University School of Arts, Design and Architecture; 3) the programme of Environmental Design at Tongji University in Shanghai where, due to the double degree programme with the PSSD classes of the Politecnico di Milano School of Design, approaches and tools of Service design have been applied.

³ I.e. 1) Studio Tilt in London, working especially on work environments design; 2) Frog Design international consultancy, with offices in Europe, USA and Asia, has applied SD methods and tools for the development of private and public services and their spaces; 3) DINNI!, a design Italian company with a strategic and consultancy attitude, designing for example innovative concepts for traditional services.

absence of a coordinated design culture⁴ and the lack in a theoretical development in the research in design is not negligible.

The aim is thus to identify a common ground for the two disciplines in order to explore areas of differentiation and of balance: these areas are identified as the *dialogues*. They explore a wide range of theories and aspects within design: overall, the study, in fact, is not focused on a deep understanding of a specific area, but remains on a higher level of research. This approach was necessary since the related overall work is a foundational shift towards transdisciplinarity between SpD and SD and the Dialogues act as converging factors in that direction, focused on a mutual and reciprocal theorising across the disciplines.

Here, the Dialogues have been organised into two main areas of exploration into design as a process: i) the evolution of the design process as an adaptive dynamic system (the meta-design approach and the evolution of a design methodology in the 1970s); ii) the narrative dimension of the design process, in terms of generation (managing the complexity of triggering creative thinking) and of representation (the management of data transfer), and their impact on the aesthetics of the relationship within the design outcome.

Several direct experiences in research projects and in educational activities were analysed as case studies⁵ and test environments analysed before and during the doctoral activity⁶ identified a lack of a specific literature review on

⁴ “Design culture” is the English translation of the Italian “Cultura del progetto”, where *progetto* has a broader meaning. It includes any discipline in which there is a planning component, where a prefiguration activity occurs.

⁵ The research activities observed, the educational activities as study cases and the interviews supporting the overall research are not included in this contribution.

⁶ Field experimentations by the author, with her research lab, have been disseminated in the following publications: Fassi, D., Galluzzo, L., and De Rosa, A. (2018). Service+Spatial design: introducing the fundamentals of a transdisciplinary approach, Service Design Proof of Concept. In *Proceedings of the ServDes.2018 Conference*. Linköping: Linköping University Electronic Press; De Rosa, A. (2017). *Unconventional spaces for art and design: enabling community synergy. A methodological approach*. In Camocini, B., and Fassi, D. (Eds.), *In the neighbourhood. Spatial Design and Urban Activation* (pp. 103-121). Milano, Italy: FrancoAngeli; Fassi, D., Rebaglio, A., and De Rosa, A. (2017). Designing a cultural event as an inclusive educational activity. *The Design Journal. Design for next. Proceedings of the 12th European Academy of Design Conference*. (Vol. 20, pp. S988-S999). London, UK: Taylor & Francis; Calvo, M., and De Rosa, A. (2017). Design for social sustainability. A reflection on the role of the physical realm in facilitating community co-design. *The Design Journal. Design for next. Proceedings of the 12th European Academy of Design Conference* (Vol. 20, pp. S1705-S1724). London, UK: Taylor & Francis; Fassi, D., Galluzzo, L., and De Rosa, A. (2016). CampUS: Co-designing spaces for urban agriculture with local communities. *PAD*, 13, 254-278; Fassi, D., Galluzzo, L., and De Rosa, A. (2016). *CampUS: How the Co-design*

this topic, highlighting the absence of supporting structures that the doctoral dissertation this contribution relies on attempts to begin to define.

The Dialogues

The first Dialogue explores the evolution of the design process as an adaptive dynamic system, dealing with the development of a meta-design approach and the evolution of a design methodology in the 1970s, specifically with regards to the disciplines of Architecture, Architectural Technology and, subsequently, to the design area that flows into SpD (Rosselli, 1973; 1974; Ciribini, 1984; Crespi and Schiaffonati, 1990; Bertola and Manzini, 2004; Collina, 2005; Branzi, 2006; Crippa and Di Prete, 2011; Crespi, 2013).

The transition towards an open methodological approach in design

The act of design is a multifaceted act since it is at the same time a creative process, where experience and intuition have a fundamental role, and a scientific process, with criteria for decision-making and rational systems. When theoreticians first began to focus on design, they applied the philosophical and practical elements of analysis as the premise for a scientific approach (Rosselli, 1973, p. 5). Following WW2, in fact, dealing with the concept of complexity as a determining condition became fundamental for an *open* methodological approach in architecture, where intuition and creativity, on one side, and an analytic and deterministic method, on the other, were not already explored as dialectical counterparts. In that period, the need for a rationalisation of the design process led to the effective introduction of methodologies coming from other important scientific fields, such as computer sciences, mathematics and statistics (Collina, 2005). From this debate, it became clear the indissoluble relationship between, on one side, reality seen

Approach Can Support the Social Innovation in Urban Context. In *Advances in Design for Inclusion* (pp. 609-621). Cham, Switzerland: Springer; Galluzzo, L., and De Rosa, A. (2016). *How educational processes and social entrepreneurship can support an urban regeneration in Milan.* In *4th International Scientific Conference A.L.I.C.E. 2016, GoingGreenGlobal International Design Week, Sustainable Design Paradigms* (pp. 72-77). Ljubljana: Faculty of Design, an independent higher education institute, Associated member of the University of Primorska.

as a complex system to be approached and understood, and, on the other, the way – *method* – to deal with reality's issues – *design opportunities* – as a complex system as well as the factors to be analysed, to be modulated into ideas among the unlimited possible solutions and, finally, to be approved for production and dissemination.

The elaboration of a *comprehensive, unique and right* method to deal with any design problem, researched by those trying to establish an operational approach for the design process is, in fact, neither a solution nor the object of design method studies. The qualitative and intuitive creative act needed a supporting methodological approach: not mechanistic but way to make sense (sense-making) of the design act immersed in the contemporary socio-technical system. As Rosselli⁷ stated (1973, pp. 9-10), design methodologies must not be operational – that is dependent on the ultimate benefit and in line with its determination – but must be reconnected to philosophical research in order to be reframed within problems that are dimensionally different. A transition from a deterministic view of the system to a complex one thus took place: methodologies in design were now seen as fundamental in guiding and making sense of design act itself.

This debate generated internal contrasts within the field, and the innovative approaches had an impact on the transformation of the idea itself of Architecture. A crisis of the discipline's unity becomes a great cultural opportunity, opening new possible paths to the design culture. Furthermore, Rosselli (1974) clearly stated that the overcoming of the contrast between architecture and design was desirably to be achieved through the development of a methodology broad enough to accommodate a more evolved and relevant social need, towards a complementarity between culture and method.

Within this complexity, the design outputs were already seen as *relational phenomena*, not obtainable through linear processes but through a complex system of prevision (models) with an impact overcoming the borders of the output itself. This logic has been transferred to the theoretical reflection on the value of space, which can't be qualitatively solved within the architectural object, rather it must be understood as part of a socio-economic sphere, where an integrated relationship between spaces and objects needed to be explored.

⁷ With the research team of the Faculty of Architecture at the Politecnico di Milano, *Progettazione artistica per l'industria* [Artistic design for the industry] course, composed by Alberto Rosselli, Adriana Baglioni, Costantino Corsini, Luigi Moretti, Marco Simonazzi, Giuseppe Turchini. Alberto Rosselli (1921-1976) was an Italian architect, designer and professor of the Faculty of Architecture at the Politecnico di Milano, co-founder of the ADI - Associazione per il disegno industriale (the Industrial Design Association).

Neither places nor objects should be seen as independent parts: the object is part of a system in time and space and space is a relational issue, resulting from certain situations, certain activities and certain objects (1974, p. 8).

Clearly rooted in this debate, a need emerged throughout the '70s to include a systemic approach to the design process itself and not only in the nature of design, thus introducing the meta-design approach and clearly driving the architectural studies reflections into the design ones, opening the Italian *cultura del progetto* to the international meaning of *design* as a disciplinary field (and not only as the pure translation of *progetto*). Ciribini⁸ spoke of the management of the design process as “*an adaptive dynamic system*”: a sequence of actions of the programmatic act of the designer, that works through qualitative models and preventive solutions (Collina, 2005). The iteration throughout the whole process is constitutive: using a meta-design approach means structuring norms able to indirectly produce infinite and different yet homogeneous morphological solutions.⁹

In these definitions, the basic notions pertinent to the design process are evident: the *notion of system* – the structural order of the relationships between the parts in a given set; the *notion of process* – when the time variable introduces the dynamic sequencing of states; and the *notion of iteration* and the *notion of creativity*. This last notion is not *opposed* to a systemic approach but is its *dialectical counterpart*: the system is the undeniable structure of reality; the system is the undeniable structure of the method as an operational and cultural reformulation of problems; creativity is the undeniable and founding variable of any human act. Hence, the design method progresses through being systemic and strategic into the techno-physical system and by acquiring provisional and probabilistic components of the human and socio-cultural environment (Rosenman and Gero, 1998; Norman and Stappers, 2015), renouncing integral control over the reality to which it is applied, through a strategic and abductive approach (Crespi, 2013, pp. 28-29).

This section highlights how the broader shifting context following the Second World War, particularly the impact of technological changes due to

⁸ Giuseppe Ciribini (1913-1990) was an Italian engineer and professor of Architectural Technology at the Politecnico di Torino. He is considered the father of the discipline of Architectural Technology in Italy. It is important to report that the process that resulted in the foundation of the School of Design – formerly Faculty of Design up until the Italian reform (L. n. 240 of 30/12/2010) – developed from the Department of Technology, then to the Department of Planning, Design and Construction [Dipartimento di Programmazione, Progettazione e Produzione Edilizia].

⁹ Mendini, A. (1969). *Metaprogetto sì e no* [Metadesign yes or no]. In *Casabella*, n. 333, p. 13.

economic and social transformation, and their many implications, had a relevant influence on the debate surrounding design methodology and in the development of Interior and Spatial Design approaches, operating between spaces and relationships. A debate in the educational process about the role of architects in rebuilding cities that brought about an entirely original point of view with regards to the role of architectural technology, in that it needed transforming, and its relationship to design and its approach. The need for methodological and systemic research derived from the inadequacy of an intuitive procedure in architectural education, which was unable to cope with new dimensional, quantitative, operational and productive problems, paved the way to the definition of a design education. The research has defined a connection between the contextual impact on the methodological development in the SpD discipline and the development of a meta-design approach with the subsequent structured acquisition of provisional and probabilistic components into the SD methodology, dealing with the complexity of variables entering into the design process through the contextual processes of co-creation and co-design. SD has developed in the last 20 years procedures – methods and tools – to deal with the creative and the operational sides of the design process, having the *relational* component at the centre of any methodological and approach evolution. SpD, instead, lacks in the development of a shareable method; that is why this *dialogue* is useful to delineate a first complementarity aspect, useful to build a S+S transdisciplinary approach.

The narrative dimension of the design process and representation

The second Dialogue explores the narrative dimension of the design process, in terms of generation (managing the complexity if triggering the creative thinking) and of representation (managing data transfer), and their impact on the aesthetics of the relationship within the design outcome (Alexander, 1977; Anceschi, 1992; Pacenti, 1998; Pine and Gilmore, 1998; Segelström and Holmlid, 2009; Bourriaud, 2010; Stickdorn *et al.*, 2011; Diana *et al.*, 2012; Forsey, 2016; Penin, 2018).

In particular, it creates a connection between the sequential dimension of the design operational process – see above – and the sequential dimension of the physical manifestations of the service interface. The inadequacy of a single intuitive procedure as a unique design methodology was argued, towards complex, non-linear, systems of previsions (models) able to understand the relationships between components within a higher level of complexity and of

variables. These *models* provide sequences of actions towards infinite possible solutions encompassing the unexpected. By reaffirming the focus on the design process rather than on the final design solution (Muratovski, 2010, 2016), the approach of SD is embraced, and the focus on the deconstruction of the design process into steps becomes of fundamental importance. Particularly, there is a clear connection with the Product Service System (PSS) dimension.¹⁰ The PSS concept represents the shift from a purely tangible dominant practice to an integrated design strategy oriented towards design solutions, where the connection between products and services is not random but conceived from the very beginning (Meroni, 2008). New forms of consumption and new social demands require a participatory complex and contextualised product-service-systems (Meroni, 2008, p. 32), designed, made and delivered on a case by case basis and viewed from the client's perspective (Baines *et al.*, 2007, p. 1549). Since PSS includes acquiring knowledge about the end users as well as all the various players (administration, associations, companies, supply chain actors etc.) and may include their engagement in some phases of the design process, this perspective is explored through processes of co-creation and co-design that are frequently discussed in SD and which have their origins in strategies of inquiry in the social sciences, e.g. Participatory Action Research.¹¹ Once again, an overall system view invests both the object of research and of practice as well as the necessary operational and cultural dimension. As Morelli states (2002, p. 6), the extension of a design activity to incorporate services requires the use of new methodological tools to address PSS, in terms of: understanding the users' needs and the friction between complex technologies and the users; the complexity of variables entering into the design process and the tools and methods to deal with this; the understanding of the material of services (Bitner, 1992; Blomkvist *et al.*, 2016); and the validation of the process via shared forms of representation, communication and dissemination.

¹⁰ A PSS is defined as a system of products, services, supporting networks and infrastructure designed to be competitive, user-centred and sustainable (Mont, 2002) and “a marketable set of products and services capable of jointly fulfilling a user's need” where a product is a “tangible commodity manufactured to be sold” and a service is “an activity (work) done for others with an economic value and often done on a commercial basis” (Goedkoop, Van Halen, Te Riele and Rommens, 1999, pp. 17-18).

¹¹ Participatory processes had little impact on service development, while they have been strongly assimilated by service design because of its co-created nature. See: Holmlid, S. (2012). *Participative; co-operative; emancipatory: From participatory design to service design* (pp. 105-118). In *Conference Proceedings ServDes, 2009; DeThinking Service; Re-Thinking Design*. Linköping, Sweden: Linköping University Electronic Press; Gilmore, T., Krantz, J., and Ramirez, R. (1986). Action-based modes of inquiry and the host-researcher relationship. *Consultation: An International Journal*.

This paves the way towards reflecting on the connection between the *sequentiality* embedded in the design methodology and the *sequentiality* needed in the representational methodology. If for Pacenti (1998, p. 104) the fact of dealing with a range of possibilities could mean a loss of the programmatic nature of design, towards what she proposed as the concept of “expanded direction”, the need emerges for a specific sensitivity including the coordination of the process together with a coordination of the overall identity of what is designed. The concept of an “expanded direction” opened the way to the one of *performance*. SD is strongly embedded in the *experience economy* (Pine and Gilmore, 1998), since services happen in the moment of the encounter, when the interaction takes place. It is when the service is *performed* (through a face-to-face interaction, a digital one or through a combination of channels between the user and the provider) that the scene of the performance becomes alive. In these terms, the service scene includes the design of the physical environment, of the tools used by the operators, of the products that the user uses directly to obtain the result and of the communicative and visual elements. The physical evidences constitute the *scenography* and the *props* of the service interface. But the design of the interface also includes the potential *plot* – among infinite yet defined possibilities – of the interaction between the user and the delivery system as a whole, including the interaction with service operators, and the human elements of the scene of interaction (Pacenti, 1998, p. 97).

In the same way, the interpretation of the space is not unanimous; spaces are also *possible mises en scène*, depending on the variables and on the complexity of the context as well as depending on the plot of the interaction. Crespi (2013, p. 41) sees the connection with worlds that are contiguous to SpD – such as cinema, visual arts, theatre and television – as inspirational for the connection between human beings and places, for the elaboration of the programmatic design idea in terms of narration, allegories and metaphors. Thus, the narrative dimension of spaces stands both in their uses and in their elaboration: spaces are, in reality, the *enablers* and the support system for interactions to take place, within a higher level of unpredictability. The relational space between artefact and observer/user is a concept that evolved throughout the last century especially with the contribution of visual art: art movements such as futurism, constructivism and surrealism studied, looking into how space is occupied by the artwork, the relationship with the observer, questioning the notions of space and time in different ways (Krauss, 2000). This cultural process merged into the loss of ability to govern the space and the need for solutions that are not univocal but flexible. This is one of the core

SpD processes: the deconstruction of the process corresponds to the structured embedding of the other components – actions, interactions – integrated in the narration of the *journey* into spaces. In this way, the no-longer static understanding of spaces could have found in its dynamic narrative a new way to design and interpret it. SpD triggers a process of exchange, being a system that creates and defines relations and exchanges between the subjects. It acts on a temporal dimension; it is not a closed system but an open and flexible one, potentially ready to accept changes (Crippa and Di Prete, 2011, p. 38). Thus, the narrative structure is open: open to the unexpected as well as to an operational act. In terms of visualisation of the process, SD usually adopts the concept of *sequencing* to break down actions and interactions and to focus on the different components of the service. This is the *service period*, divided into pre-service, during-service and post-service phases: various methods and tools are used to explore and exploit the steps and the variables along the sequence, both as generative tools and as representational ones. The first is the case of live narratives such as the *desktop walkthrough* or *bodystorming*. Representational tools deal with the management of data transfer; it is the case of *storyboards* and *journey maps*, or of *system maps*. Without delving into too much of an in-depth description of these tools, which are codified and shared by the scientific community (both in academia as well as in the agency and practice environments), it is interesting to highlight how SD has identified structured ways to deal with the processual nature of services and to transfer them into the design process, at the operational level and at the representational one, to enact the creation, validation and capacity of communicating the complexity of the object to be designed. Instead, SpD, even if is itself defined within the development of a design methodology as illustrated above, has not yet incorporated sequential, temporal and narrative components in its representational tools, which are still more connected to a static visualization of the overall physical evidence, and limiting the communication of possible futures embedded in the design of a place. Plans, sections and 3D models, at the same time, demonstrate the ability to provide an overall representation of the physical side and flow charts or functions are unlikely to be able to provide the sense or the aesthetics of the relationship, meaning the narrative structure of the story (Pacenti, 1998, p. 105) that includes the time-span. Aesthetics, which has traditionally been connected to the spatial dimension and to its symbolic values transferred through words-images-forms, has thus acquired a temporal dimension and unfolded into the time of the interaction, the engagement, the participation, and the relationship that SD has acquired in its process and methodology. Representational and generative tools from SpD and SD could therefore be explored as possibly complementary approaches, to include the

physical evidence, the aesthetics of the relationship and the sequencing within the time-span. This need emerged when SD emerged as a discipline.

Conclusion

It is important to understand the ability of SD to have developed a diverse range of methods and tools for representing and managing the complexity of the systems taken into account and to be designed, aware of the fact that there is no unique way to represent the *full story* of a design. Visualisations are used in SD as tools for translating raw data into insights and as a way to communicate these. Conversely, SpD has explored, throughout its history linked to the discipline of Architecture, methods and representational tools aimed at representing the object of the design itself, with codes and regulations, while lacking *the rest of the story*. In other words lacking in defining codes and tools to generate, communicate and visualise the space's potential to be an *enabler* of interaction within its exploitation.

The unfolding of services in the physical environment implies and determines a narrative dimension where the physical evidences constitutes the scenography and the props of the service plot. Both the design of services and the design of spaces are possible *mises en scène*, enabled by design itself and within a state of unpredictability. The *sequencing* nature of SD's object and process is codified into operational and representational tools while SpD's representational tools are still more connected to a static visualisation of the physical elements. Time sequencing and spatial aesthetics should merge in a complementary orientation towards an *aesthetic of the relationship*, including the spatial dimension and its symbolic values as well as the time of the interaction, the engagement and the participation. This leads to an integrated design of spaces taking into account the narration of flows. The diverse methods and tools of SD and SpD for representing and managing complexity, making the service performance tangible and expressing assumptions and processes, offers a codified range to represent the full story of a design solution broken up in fragments.

The doctoral thesis results in a taxonomy, a qualitative comparison which outlines principles for the foundation of an S+S approach, showing how aspects of the two disciplines can serve to show the needed complementarity towards a S+S transdisciplinary coordination. The taxonomy has not been presented here. This contribution is meant in fact to propose only a part of the wider landscape on which the taxonomy relies.

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Internationalizing the Fashion Design Curriculum: Nurturing Internationalized Talents

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Abstract

Globalization has created a new norm that affects all aspects of our daily lives. We may have noticed that the fashion industry in our time has not only become more global but also more knowledge-based. The new realities and shifts in the job market have fundamentally changed our fashion education system. With an increasingly diverse student body, universities are requested to rethink their long-standing philosophies towards the emerging paradigm. There has been much discussion about ways in which more advanced systems can support the development of fashion education internationalization where there is an urgent need to nurture internationalized talents. Hence, with this study, the researcher intends to explore the operationalization practice of curriculum internationalization within and across the discipline of fashion design, while at the same time identifying potentially effective strategies to internationalize the fashion design curriculum. By applying the defined theory of curriculum internationalization and translating it into new practices, demonstrating the connection between the theory of implementation and the reality of implementation practice. The researcher hopes that the positive and practical results of this study might offer a valuable reference point and inspire other educators from different backgrounds to better explore the theory and practice related to curriculum internationalization in the future.

Introduction

When looking up the word ‘globalization’ in the etymology dictionary, we could find that the term derives from the word ‘globalize,’ which refers

to the appearance of global economic systems. In the book *The World Is Flat*, the American journalist Friedman (2006) conceptualizes three stages of globalization: Globalization 1.0 (from 1492 to 1800) shrank the world from large to medium, due to countries' globalization. Globalization 2.0 (from 1800 to 2000) shrank the world from medium to small, as a result of companies' globalization. Globalization 3.0 (from 2000 till now) brought the world from small to tiny, with individual becoming globalized.

We may have noticed that in such an unprecedented period of globalization, the jobs that once required low educational level or less specialized skills have substantially disappeared, while new job types that did not exist before have been created. The cross-border mobility of ideas, people, and financing, intertwined with innovation in communication and technology, are fundamentally changing the job market environment as well as our higher education system. There was much discussion about ways in which the more developed systems can support the growth of internationalization of higher education where there is an urgent need to nurture the internationalized talents.

With this study, the researcher intends to explore the effective operationalization practice of curriculum internationalization within and across the discipline of fashion design. The motivation for studying curriculum internationalization is due to its vital role in the university internationalization process. While fashion design as a young yet significant academic discipline needs to expand its entrenched practical-concerned paradigm and to include a broader range of research activities, the rapidly evolving landscape of the fashion education market worldwide requires universities to rethink their long-standing philosophies towards the emerging paradigm. By carrying out this study in the fashion design disciplinary context, it provides us with valuable insight and possible ways forward for developing internationalized curricula in different contexts. The researcher hopes that this study might offer a solid basis and reference point for relative future works.

Stating the problem

Over the past 25 years, internationalization has become a priority for both universities and governments. In the Bologna Declaration of 1999, two demands of internationalization were brought forward: 'cooperation and competition' (De Wit, 2011, p. 244). However, the definition of these two intertwined dimensions brought about confusion and misconceptions about what, why, and how to internationalize global education. As Barnett and Coate (2005) claim, one big challenge for internationalization of higher education depends on its

core concept of ‘curriculum.’ They observed that, in higher education, most educational programs and projects are proliferating, with ‘ironically scant attention’ (Green and Whitsed, 2015, p. 11) paid to the curriculum. ‘Curriculum design is rarely a reflective practice in universities’ (Barnett and Coate, 2005, p. 2). Leask (2015) concurs that, as a crucial concept, curriculum internationalization is ‘poorly understood’ and underdeveloped in practice across disciplines (Shiel and Takeda, 2008, as cited in Leask, 2015, p. 3). When dealing with internationalizing a curriculum, one of the fundamental questions was: ‘how can we internationalize the curriculum in this discipline area, in this particular institutional context, and ensure that, as a result, we improve the learning outcomes of all students’ (Green and Whitsed, 2015, p. 53)?

As the understandings of curriculum internationalization ‘vary in different disciplines and institutions’ (Leask, 2015, p. 27), there have been a number of practical and methodical inquiries into the relationship between curriculum internationalization and academic disciplines, circumstances regarding the discipline of fashion design are even fewer. Fashion is a remarkable indicator of cross-cultural interchange has entwined throughout our society. Today’s revolutionary change within the fashion industry and education market worldwide has evoked a great challenge and impact with regards to the current dominant paradigm in the fashion education system. Therefore, with this study, the researcher attempts to explore the boundaries between the dominant and emerging paradigm, by applying the defined theory and translating it into new practices, demonstrating the operationalization practice within and across this discipline area, while at the same time identifying the potentially effective practical strategies aimed at internationalizing the fashion design curriculum.

Research methodology

As the objectives of the study had not been previously studied comprehensively, the researcher decided to adopt an instrumental case study as the leading research strategy. The case study approach enables the researcher to gather ample data and to examine it closely within a specific context (Zainal, 2007). One particular case is adopted as an instance to shed light on the study’s questions. The structure of this study comprises means methods of data collection, which lead to a triangulation of methods (fig. 1) for the analysis. Since a single method can hardly shed light on a complex phenomenon, adopting multiple methods can help researchers develop a comprehensive understanding of the internationalized fashion design curriculum.

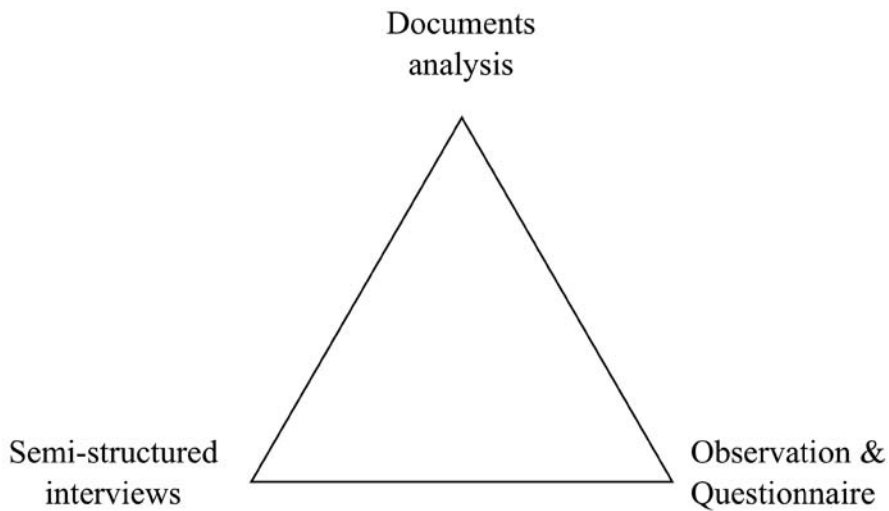


Fig. 1 – Triangulation of research methods..

Setting the scene

Fashion design education differs dramatically from country to country, due to their distinctive educational systems, various demands from local workplaces, and perceptions towards fashion as an academic discipline. This research stresses primarily the interaction between Italian and Chinese fashion design education systems. According to the *First Education Market Monitor Summit* in 2017, there is a pressing demand to analyze the Italian fashion education system on a global scale, while at the same time understanding the evolutionary trends and competitive positioning of the Italian fashion design schools. While in China, greater emphasis has been placed on design education, especially the curriculum system. Internationalizing the curriculum, as an essential aspects, has been assigned a key role in the internationalization agenda for higher education in fashion and design in China. In view of this context, a unique international program focusing on the internationalization of fashion design education between Politecnico di Milano (POLIMI) in Italy and the Beijing Institute of Fashion Technology (BIFT) in China was established in 2014. With this program, the hope is to better explore the practices and strategies regarding the internationalization of the fashion design curriculum.

The program

The program between POLIMI and BIFT started in September 2014. The curriculum developers and researchers from both institutions believe that a program of this kind is a precious opportunity to investigate the connection between theorizing about the implementation and the reality of implementation practice. As of September 2018, there have been seven groups and a total of 79 students who have participated in the program. The participating students are third and fourth-year undergraduate students from various schools in BIFT, who take part in the program and spend an academic year in Milan. Even though this program has been highly valued and praised strategically, from a practical perspective, we can barely find other similar cases academically available for reference. Therefore, the researcher intends to delineate the program in detail and hopes the delineation of this case, the reflection, and the discussion might contribute to the current understanding and future studies.

Delineation and discussion

Review and assessment

In the early stages of analyzing the program, it is essential to clarify its goals and to think to what extent the curriculum should be internationalized (Leask, 2015). It is, therefore, fundamental to have a comprehensible understanding of the participating students, of their specialized skills and background, competencies and capabilities. This phase of curriculum internationalization process lays the foundations for mapping out the subsequent³ stages. In this study, three complementary methods are adopted to shed light on the issues at hand: documents analysis, student's competencies assessment, and interviews with curriculum developers.

Documents analysis

Before planning the curriculum structure, it is essential to compare the similarities and dissimilarities between different educational systems and approaches, in order to identify the gaps in the existing set of curricula. The researcher, therefore, carefully reviewed the curriculum profile from both schools. The documents analysis reveals that the pedagogical approaches

adopted in the two schools are rather different. In BIFT, the fashion-related majors are subdivided into various specific areas. The curriculum focuses more on the vertical training of student's intra-disciplinary skills and intra-personal competencies. In POLIMI, the degree programs are delivered in a systemic manner. The curriculum focuses more on the horizontal training of students' inter-disciplinary skills and inter-personal competencies. Different teaching methods train students with different abilities, it would be beneficial for students from both institutional backgrounds to work together and learn from one another.

Student's competencies assessment

The analysis of the written material related to the curriculum profile gives us a broad insight into a student's specialized background, while the assessment of a student's competencies is also considered valuable to curriculum planning. In this study, the researcher applied a specially designed students' core competencies assessment questionnaire, in order to acquire a general understanding of these students' competencies and abilities. Besides the numeric data collected through the questionnaire, the researcher also conducted a workshop at BIFT in 2016, intended to perceive the student's competencies further and to observe their attitudes when engaging with a differentiated studio-based teaching approach. The student's competencies assessment results suggest that the curriculum could be designed with the aim to train the following competencies:

- Cognitive: critical and reflective thinking, rational decision making.
- Inter-personal: communication and presentation skills, collaboration and teamwork, leadership, global awareness.
- Intra-personal: independent learning, self-awareness, self-motivation, flexibility, and adaptability.

Interviews with curriculum developers

During the early stages, interviews with experienced international curriculum developers provided essential knowledge while designing the curriculum for the program. The curriculum developers understand the learning processes of young students. They can correctly guide the curriculum towards an effective transmission of knowledge. In this study, the researcher has interviewed three curriculum developers from three different countries and institutions.

The interviews with the curriculum developers indicated that an international program of this kind should be viewed multilaterally:

- Firstly, it is fundamental to identify what kind of disciplinary knowledge and cultural experiences should be offered to international students.
- Secondly, it is essential to consider how to deliver the equivalent or appropriately differentiated knowledge and experience for both international and local students.
- Thirdly, it is crucial to balance the short-term achievements with long-term goals. The policymakers should direct and balance the values that the international students bring into the program and that they bring back with them.

Design and implementation

Based on the knowledge acquired, a ‘pro forma’ internationalized curriculum model (fig. 2) was elaborated for the program. The curriculum structure is composed of two complementary integral modules. The ‘polytechnic module’ and the ‘personalized module.’ This curriculum model has then been tested over two to three periods in order to gather student feedback in view of further adjustments and improvements.

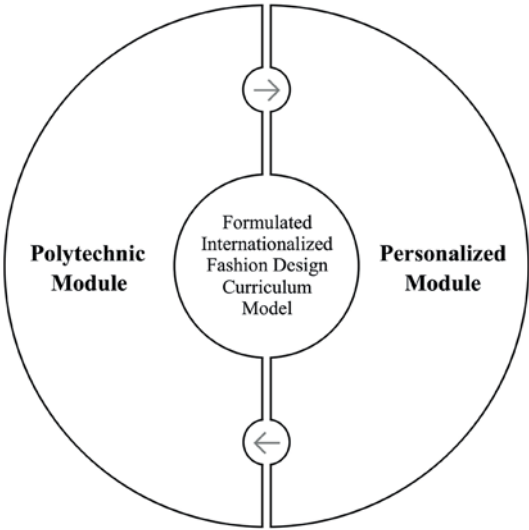


Fig. 2 – The formulated internationalized fashion design curriculum model.

The polytechnic module

In the POLIMI education system, the *laboratorio*, as a distinguishing characteristic of the university, improves and connects its fashion degree programs. In the polytechnic module, the priority is, therefore, given to the fashion design *laboratorio* courses. The ‘*laboratorio*’ is an educational innovation emerged at the end of the seventies in Germany. Those who supported this innovation considered that learning is not the product of a teaching process, but a process in which direct experience engages the learner. It is a place in which to combine theory with practice, to construct cognitive knowledge, and to work cooperatively. One entire *laboratorio* lasts a semester and sees the participation of a multidisciplinary team of professionals, designers, students from different design disciplines and cultural backgrounds. The courses aim to give students through short intensive workshops the most extensive knowledge of the fashion industry.

The personalized module

When talking about how to design the curriculum for international students during the interviews, the curriculum developers suggested that it is beneficial to design the corresponding teaching content and activities according to students’ various cultural backgrounds. Accordingly, for the program, a personalized module is integrated to complement the polytechnic module. This personalized module aims to emerge the formal curriculum with the informal and hidden curriculum, it helps students to overcome their cultural limitations, open their minds, and guides them to apply the knowledge they acquired immediately to the real world. This is achieved by involving the students in activities such as visiting museums, companies, international fairs, participating design events, seminars and workshops, helping them to fully immerse themselves and grasp the meaning of fashion and design ‘intuition’, as a way to also transfer tacit knowledge to the students.

Evaluation and adjustment

Curriculum design is a cyclical process: each time one course is taught, the feedback is collected from the students. As the tutor of the program, the researcher was able to observe and have honest conversations with students and teachers throughout the entire program. From the feedback and obser-

vation during the teaching and learning processes, several potential adjustments can be proposed for the improvement of the program:

- An integrated preparatory course: to reduce the impact of the teaching and learning styles' mismatch, and help students to build up self-confidence in their ideas and attitudes.
- A practice-led research methods course: to fill up each student's knowledge gap in design methods and help them develop logical thinking with regards to various practices.
- An improvement in designing the learning materials: since the English language is not the official language of these two countries where the program is delivered, more attention should be paid when designing the learning materials and activities.
- A potential online and remote-learning module: such a module should be considered for further revision in order to illustrate the program's flexibility.

Reflection on the practice

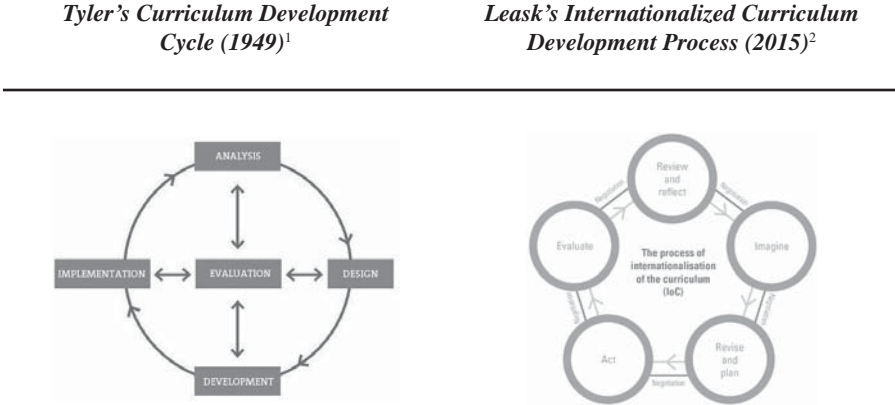
The development process of the internationalized curriculum

In 1949, American educator Tyler proposed a curriculum development cycle, providing a set of guidelines for institutions to formulate a curriculum fitting their purpose. Based on the traditional approach of curriculum development and review process, in 2015, Leask proposes a five-stage process of internationalization of the curriculum (tab. 1). Compared to Tyler's curriculum development cycle, Leask's process framework has one key difference: the *Imagine* stage. Leask (2015) believes that this stage could stimulate creativity by challenging the traditional and dominant paradigm, and including a broader and deeper engagement of the faculty while constructing the curriculum (p. 41).

However, during the practical implementation, the researcher observed that the boundaries between each *stage* as mentioned by Tyler (1949) and Leask (2015) were blurred, less clear-cut, sometimes even overlapping and repetitive. In order to avoid adopting a narrow focus when applying the frameworks, it would be advantageous to take a step back, to view the process from a relative broader-ranging standpoint of *phases*. Therefore, in this study, the practical side was carried out in three developmental phases: the prophase, the metaphase, and the anaphase. Every phase refers to major time segments that span the cycle of a curriculum internationalization process

from start to finish. With the stages considered as sub-phases, they could be adjusted and ‘customized’ to merge, to expand, to overlap, to interchange, in order to better adapt and reflect the specific implementation area of the process of internationalization of the curriculum. The relationship between the *phases* and the *stages* of the internationalized curriculum development is illustrated in fig. 3.

Tab. 1 – The development processes of the internationalized curriculum.



Four basic principles:

- What educational purposes should be the schools seek to attain?
- What educational experiences can be provided that likely to attain these purposes?
- How can these educational experiences be effectively organized?
- How can we determine whether these purposes are being attained? (Tyler, 2013, p. 59)

Five core questions:

- To what extent is our curriculum internationalized?
- What other ways of thinking and doing are possible?
- What will we do differently in our program?
- How will we ensure that students/staff are best supported to achieve our internationalization plan?
- To what extent have we achieved our internationalization goal?

¹ Godden, P. (2014, September 26). Tyler’s basic principles of curriculum and instruction. *Talk curriculum*. Retrieved from <https://talkcurriculum.wordpress.com>. Accessed on December 10, 2018.

² Leask, B. (2015). *Internationalizing the Curriculum*. New York, NY: Routledge, p. 27.

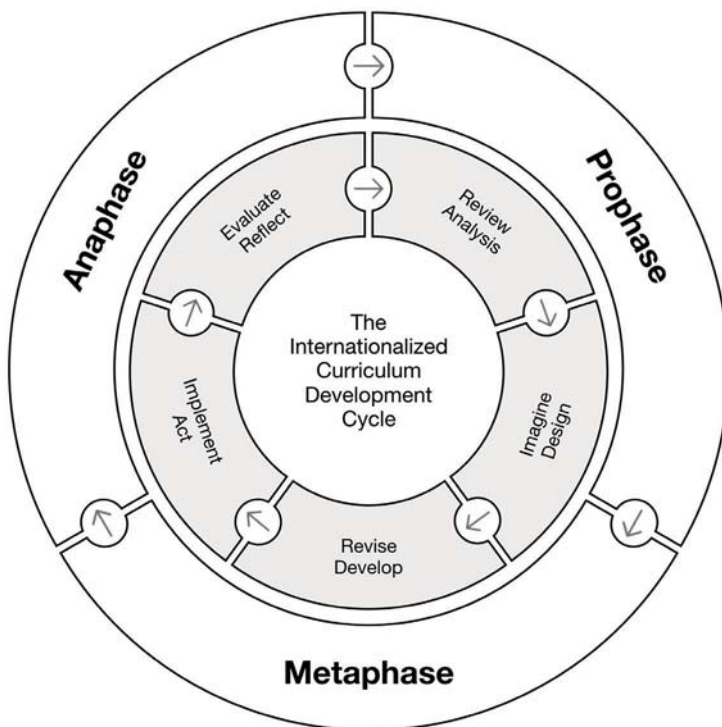


Fig. 3 – The internationalized curriculum development cycle.

The development phase cycle explained

Prophase

Key point: Avoid overstating or understating the extent of the program, a thorough investigation of the participants is crucial to balance the long-term goals with short-term achievements, the support from intermediate facilitators is indispensable.

For any process of curriculum design, from the very beginning, it is essential to clarify the program goals and objectives. It is fundamental to discuss with internal teams and negotiate with external partners to make sure that these are the same goals that both sides aim to achieve. During this phase, the support from intermediate facilitators is indispensable. Expert intermediate facilitators are able to interpret the implicit message of contexts, encouraging meaningful intercultural and interdisciplinary dialogues.

Metaphase

Key point: To consistently explore the boundaries between the dominant and emerging paradigms within the discipline, an appropriately differentiated curriculum is effective and beneficial, the establishment of a safe learning space is essential.

This phase is considered essential and integral, as it challenged the mechanism hitherto taken for granted, and demands a broader engagement in constructing the curriculum. The globalization phenomenon has had a significant impact on traditional teaching methods. With students coming from the different cultural and institutional backgrounds, it is challenging to have them together in the same class and teach them with predetermined methods. The curriculum developers suggested during the interviews that one solution is teamwork so that students can learn from each other. Another option is doing personalized curricula, which could help integrate students' disciplinary knowledge and competencies.

Anaphase

Key point: For ensuring the cyclicity of the process, the multilateral engagement is critical to diminishing the operational gaps: honest feedback and conversations are fundamental.

The curriculum structure should be seen as a whole rather than in its isolated parts, the evaluation of the achievements of the outgoing cycle and improvements of the incoming cycle should be discussed and negotiated together by all the participating members. To have an honest dialogue with participating members throughout the program is fundamental. Their genuine feedback can help to stimulate the further improvement and development of the process. By reflecting on the feedback collected, the sub-phases of the process and the methods adopted during the implementation practice could be adjusted accordingly, in order to ensure the effectiveness of the designed curriculum.

Conclusion and recommendations

The internationalization of the curriculum is an indispensable part of the higher education internationalization process. Even though much has been achieved in understanding the concept, there is still much more to be done. There is relatively little research and just as little practice regarding the op-

erationalization of curriculum internationalization in disciplines, even less so in fashion design. With this study, the researcher explored the operational practice of internationalization of the curriculum within the discipline of fashion design, with possible improvements and adjustments proposed and to be implemented in the future. However, in the meantime, we noticed that very little evidence had been found regarding the long-term impact of the students who have engaged in this internationalized fashion design curriculum. How did this experience influence and match up to their expectations and career developments after returning to their country of origin? That would be an exciting direction to investigate more closely. Another potentially interesting area to be researched would be the influence and impact that the curriculum internationalization brought to the local students and faculty. It would be very beneficial to follow up with their views and analyze in greater depth their concerns about curriculum internationalization, as well as the debates on the relationship between localization and globalization.

This study brings new knowledge and insights to the existed theoretical frameworks. Contributions are made to both the program participants, and the fellow researchers who intend to develop similar works. The researcher hopes that the positive and practical results of this study might inspire other educators from other regional, national, institutional, and disciplinary backgrounds to better explore the theory and practice related to curriculum internationalization in the future.

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Designing Knit Designers. Teaching tools and methods to train professionals for the knitwear industry

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Abstract

This study focuses on Italian knitwear both as an industrial excellence, placed halfway between tradition and technological innovation, and as a design discipline taught in design universities, with the aim to experiment with new ways to support SMEs and to answer their concrete needs in terms of young professionals.

On the academic side, the growing correspondence of the disciplines of fashion design with their respective specialized production areas creates an opportunity for knitwear to be addressed in this study from a designer-researcher perspective, and thus to be recognized as a discipline that deserves specific teaching tools and methods and focused scientific research. From an industrial standpoint, knitwear is one of the most complex realities of Made in Italy, with a long and fragmented production chain made up of many different stakeholders that leads to significant waste in terms of time, resources and materials leaving a low budget for the training of new designers.

In this scenario, it is increasingly urgent for higher education to understand how to train knit designers as professionals able to act in between tradition and innovation, owning creative and technical skills along with with specific competencies, other than those of a more generic fashion designer.

The study works towards this objective, keeping knitwear inside the boundaries of the Italian industrial design culture and acting with experimental activities towards the definition of tools and methods to train professionals to be able to respond to the needs of the industrial context, with the proper technical and cultural knowledge and the project-oriented mindset that is typical of industrial design disciplines.

A Complexity to be Addressed

This study takes its place within the research carried out by the fashion design scientific community at the Politecnico di Milano over the past ten years, treating it as a branch of industrial design (Bertola, 2007). As part of the industrial design culture, the fashion system has developed in its areas a high degree of specialization of the creative and productive chain (Dell'Acqua Belavitis, 2007). If with the first doctoral thesis in fashion design (Conti, 2007; Colombi, 2007; Vacca, 2009) the scientific research in this area has structured and developed the methodological groundworks for the construction of the Fashion Design degree at Politecnico di Milano, the academic discourse is now moving towards these specific realities, focusing on jewellery design, artisanal techniques, technology and interaction. This thesis has therefore set itself the aim of focusing on a specific area of knitwear design (KD), that is often left as a simple variation on the theme of fashion but which is a peculiar source of innovative industrial and technological experimentation while being at the same time one of the most traditional sectors in Italy (Conti, 2016).

Focusing on the Italian scenario in particular, the present study intends to represent an effective response to the needs of the industrial sector: from this point of view, indeed, knitwear is a very interesting field to be addressed, as it is one of the most complex realities between the excellences of the Made in Italy brand, with a long and fragmented production chain made up of many different stakeholders. This complexity leads to significant waste in terms of time, resources and materials and leaving a low budget for the training of new designers and for knowledge transfer inside companies. Nonetheless, in an industrial scenario that is continuously renewing itself, a concrete need to train new professionals is becoming increasingly urgent, able not only to innovate the processes of the whole production chain of knitwear, while also keeping an eye on the craftsmanship and on the traditional work this industry originated from (Affinito *et al.*, 2017), in order to act, therefore, in between tradition and innovation, creativity and technique. It is in light of these premises that this work has moved from the hypothesis, addressed in the reviewed literature, that KD requires a cultural background and specific competencies that are different from those of a more generic clothing designer (Traini, 2004) and, therefore, a specific set of teaching tools and methods and a peculiar area of university research.

From a designer-researcher perspective, whoever deals with the training of knit designers inside higher education institutions (HEIs) has the duty to understand how the methodological and educational boundaries of this design discipline are expanding and what tools and design methodologies are at

designers' disposal for them to be successfully embedded within contemporary production and consumption scenarios, which means to conceive a form of design that "is not industrial design in the sense of designing products, but industry-related design, design as thought and action for solving problems and imagining new futures" (Friedman and Stolterman, 2014, p. X)

This study intends to address the complexity of the knitwear industry from this educational perspective, investigating what kind of competencies should be possessed by a well-prepared professional figure in order to respond to the needs of the industrial context, whether or not KD education needs specific design tools and methods and how these tools can deliver proper technical and cultural knowledge, along with the project-oriented mind-set that is typical of industrial design disciplines.

A Multifaceted Approach to Knitwear Design

To support the validity of KD as an area of inquiry and to give it structure from an academic point of view, the theoretical background of the present study addresses the topic from four different perspectives.

First, KD is addressed as an area of inquiry for scientific research within the relatively new academic discourse ongoing in fashion design (Bertola, 2006; Simonelli and Colombi, 2005; Ruppert-Stroescu and Hawley, 2014; Kawamura, 2005; Dell'Acqua Bellavitis, 2007; Conti, 2007). **Second**, knitwear is framed as an industrial sector among the excellences of the made in Italy brand (Fortis, 2015; Pieraccini, 2017), in order to understand how knitwear is integrated into the Italian fashion system, what it has in common with the more general field of fashion (Bertola and Colombi, 2014; Micelli, 2011; Corò and Micelli, 2007) and what are the specific traits of the sector (Annicchiarico, 2009; Traini, 2004). **The third** perspective analyses the educational system of industrial design in which this study is inserted. **Starting** with a first focus on the pillars that uphold industrial design disciplines (Buchanan, 2001; Friedman, 2003; Cross, 1982; Schön, 1983), the attention then focuses on the teaching tools and methods in use to train designers when they operate in a specific industrial context as the Italian one, to then understand how these methods have been transferred from design to fashion design education (Bertola, 2009; Giusti 2009; Volonté, 2012; Penati and Seassaro, 2000), to train actual designers and not artists (Kawamura, 2005). This framework represents the starting point for the study to work on KD education with a set of methods which belong to the industrial design culture rather than to the still common artistic perspective in the fashion world. **The fourth** gives

an overview on what is known and established about the KD process, its stakeholders and the role of designers inside it (Eckert, 1997; Eckert *et al.*, 2002; Traini, 2004; Petre *et al.*, 2006; Sissons, 2010; Conti *et al.*, 2016). KD emerges as a poorly explored research field but also as a complex creative and productive process with its own specific issues.

The four areas define and explain the background of the entire study, its framework in the Italian context and the reasons for taking this approach to analysing the topic.

The literature review led to the questions that guided the whole study:

RQ1: *Does KD education need to be specifically structured with dedicated tools and methods?*

RQ2: *What kind of competencies should this specific education transfer to young knitwear designers to make them able to answer the needs of such a unique industrial context?*

RQ3: *In light of the competencies required, which features should KD teaching tools and methods have, in the to-be-pursued balance between technical and cultural knowledge, industrial mind-set and creativity?*

Given the research questions, the main objective of this study is to experiment, build and define the exchange of knowledge between universities and companies, to address the specific needs of the industry and fill the existing gap of practical knowledge inside universities, with benefits on the one side for students, researchers, and professors, and the other for professionals, managers, and the business environment as a whole. Educational activities are the tool used to work towards this result, with the final aim to develop a teaching strategy with new tools and methods for KD education at a university level, and to create a synergic system between the academic-didactic realities and the industrial territory.

To reach the set objectives the study is structured through qualitative methods and divided, after an initial literature analysis, into two main stages: a preliminary research phase with a parallel investigation into knitwear as an industry and as a design discipline, and a following experimental phase based on practical experience conducted with the applied research approach.

Preliminary Research: a Twofold Investigation

Due to the presence of very little literature and scientific research about the topic, the first phase of the present study intends to broaden the view on

the state-of-the-art and to build new knowledge which can be useful to then intervene with impacting experimental actions.

To do this, the preliminary investigation has been conducted on two parallel tracks, to acquire knowledge on the **two macro areas of research interest**: KD as a part of the industrial Italian fabric and as a discipline taught in design universities. The aims were to explore the problems, honour the voices of participants, map the complexity of the system, and convey multiple perspectives of participants: circumstances that Creswell and Plano Clarke (2011) place as the most suitable to qualitative methods of inquiry.

For the **first macro-area of research**, knitwear as an industry, the investigation had multiple aims: to obtain a clearer picture of the sector, identifying the best practices between the stakeholders and framing the productive process in all its steps, also understanding the tasks and the relations between stakeholders and the role that a designer could undertake along the supply chain. The attention is also focused on understanding the needs of expert professionals in terms of young designers and of relationship with universities.

To collect information, observations during visits to companies, shops and trade fairs were combined with desk research and semi-structured interviews with professionals. The relevant companies were selected inside a precise framework of investigation, the Italian context, as Italy is a privileged research scenario with a complete supply chain specialized in knitwear, from the processing of raw material to the production of finished products. As stated earlier, it is a fragmented and complex system grown with the interaction and the exchange of knowledge between a multitude of small and rarely medium manufacturers: spinning mills, that transform the raw material into yarns; fashion brands, that create excellent products in line with typical Made in Italy features; knitwear factories, that are in charge of materially realizing the end products. The entire system is highly rooted in the territory, especially in the areas around Biella, in Piedmont, Carpi, in Emilia Romagna, and Prato, in Tuscany which are the current industrial districts of knitwear, along with the areas of Bergamo, Brescia, Padua e Treviso.

Studying Italian knitwear means also to take into consideration the rich relations between local SMEs and the international context, which represents the major market for the sector: the research therefor looks into international fairs, such as FILO and Pitti Filati; the most important certificatory bodies operating on a global scale and the most important producers of industrial knitting machines. These stakeholders turned out to be very important for this study, being facilitators in creating networks among not only companies, but also between companies and universities, which make up the most

interesting areas of experimental action within this study. Information was collected from a total of 24 stakeholders, listed in fig. 1.

	SPINNING MILLS	KNITWEAR FACTORIES	FASHION BRANDS	MACHINE PRODUCERS	OTHERS
Brunello Cucinelli		●	●		
Casa del Filato	●				
CELC					●
Elementi Moda					●
Filmar	●				
Filoscozia			●		
Filpucci	●				
Fondazione Ferrè					●
Ghioldi		●			
Hosio		●	●		
Imax		●			
Loro Piana	●	●	●		
Maglificio Ellynore		●			
Maglificio MF1		●			
Maglificio Pini		●			
Missoni			●		
Pecci Filati	●				
Sandonini				●	
Shima Seiki				●	
Stoll				●	
Studio Marelli					●
The Woolmark Company					●
Tollegno 1900	●				
Zegna Baruffa L.B.	●				

Fig. 1 – List of the analysed stakeholders with their role on the supply chain.

This analysis led to the definition of two of the main pillars on which the entire study is based.

First, it highlighted the needs of the industry in terms of young designers, the most relevant necessity of specifically trained professionals in the field.

Companies need designers:

- with the ability to communicate effectively using the technical language of knitwear
- with specific technical knowledge
- who are aware of how new technologies work
- who are specialized in research and development on yarns
- who have a clear picture of the whole manufacturing process, with its stakeholders and its production steps
- who own soft skills, teamworking most of all

Second, it allowed the researcher to define and describe all the steps of the productive process, answering the important question ‘*who needs a knitwear designer?*’ with ‘*almost everyone*’: the strong contribution of the competencies of a specialized knitwear designer indeed emerged not just within the style departments of fashion brands but in many steps of the chain and with all the stakeholders.

The **second macro-area of research** delves deeper into the existing training offered for future knitwear designers and the teaching methods used, with the aim to identify the most effective methods and patterns of knowledge transfer.

Here the methodology combined participative observation, carried out during a variety of teaching activities at the Politecnico di Milano (BA curricular courses and workshops, post-graduate courses, BA thesis development) with the mapping of other Italian and international universities that provide KD courses, built up primarily through desk research plus semi-structured interviews to teachers and students.

Participative observation has been key to understanding how, in the same discipline, teaching tools and methods can be so different depending on the students’ background, on their previous skills, on the available time and facilities to develop a given project. Alongside this, the mapping of the educational offer in ten national and international universities – selected among the leading fashion design schools with specialist courses in KD – mainly aimed at investigating the structure of their programme and, useful in equal measure for this study, to understand if they have a connection with the industrial context of the territory.

Given the identified needs and desires of the knitwear industry, this second track of preliminary research led to assume hypotheses of intervention for HEIs to address them properly (fig. 2).

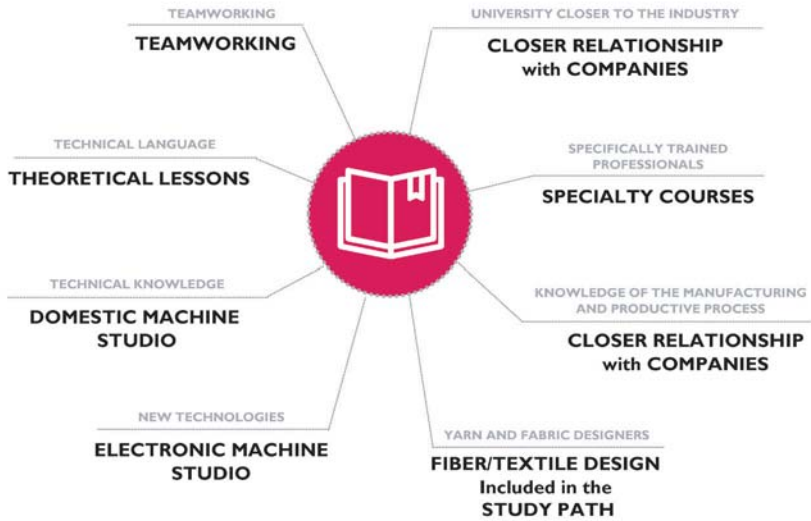


Fig. 2 – Hypotheses of intervention to address each identified need.

This preliminary research phase confirmed what was found in the literature and led to the formulation of two research hypotheses, to be verified later during the experimental research phase.

The importance of a technical, technological and up-to-date knowledge defines **RH1**, that states that **in KD there can be no creation without a technical background**. Throughout the interviews a common theme is that knitwear is not at all just a creative exercise but a technique, a tool for creation that has to be mastered and needs a high level of specialization. The knowledge of designers has to contain both creativity and technical knowledge, in order to make them able to interact in the most effective way with the various actors of such an articulated industrial structure made up of spinners, knitwear factories, brands, certificatory bodies and machine producers.

Since a large portion of the interviewees – professionals and academics alike – reported the belief that industry and university should be more deeply connected, **RH2** assumes **innovative ways of relationship between university and industry to be a facilitating asset to effectively answering the emerging needs of the knitwear industry**.

Experimental Phases

Experimental Phase 1 (EP1)

The preliminary research findings allowed the researcher to start setting up a **methodological framework** for KD teaching to be better defined, applied and evaluated during the consequent phase of experimentation.

The framework, made of tools, methods and directions in which to teach KD, is based on the simplified design model given by Hertzum (in Simonsen *et al.*, 2014, p. 27), that presents four basic elements (fig. 3). First, designers – students, in this case – must understand the **existing situation** through experience and through learning a common language for communication. Second, designers must explore the **technological possibilities** at their disposal. Third, the **design process** must be organized and planned, in order to match the situation and the technological possibilities. Fourth, the **new situation** must be envisioned and concretely experienced with prototypes and simulations.

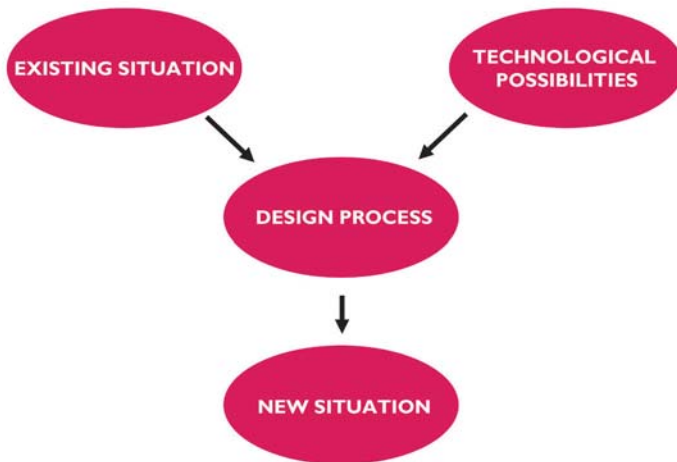


Fig. 3 – The design model by Hertzum (2014).

Taken as a reference, Hertzum's model has been applied and adapted to the specific features of KD, associating to each element the skills and knowledge that should be provided to KD students through lectures, practical lessons, tutorials and experiential learning, in order to reach the relative objective. As the prior investigation demonstrated that in KD the design process and the making of samples and prototypes are integrated and result

from a series of activities which go back and forth from one to the other, the outline of a KD framework has been structured as composed by three elements instead of four, incorporating the prototyping moment into the design process (fig. 4).



Fig. 4 – First outline of the framework organised with all the useful skills to be taught in order to reach the three objectives of the design model.

The framework has been tested through field experience during eight formative activities, each different in their own timeline, number of students and their background, companies involved and the setting (fig. 5).

	TIME	n° OF PARTICIPANTS	BACKGROUND IN KD	COMPANIES INVOLVED	SETTING
MISSONI PROJECT Final Synthesis Studio A.Y. 2016/17	4 months	48	none	Missoni The Woolmark Company Zegna Baruffa Lane Borgosesia	3rd year curricular BA course at Politecnico di Milano
WORKSHOP Design with Linen A.Y. 2016/17	1 week + 5 months	48	basics	CELC	3rd year curricular workshop at Politecnico di Milano
MAD 2017	5 days	15	none	none	Workshop in Master course at POLI.design
DDM 2017	6 weeks	8	varied	none	Post Graduate course at POLI.design
BCUWS A.Y. 2016/17	5 days	11	none	none	Workshop for Level 4 students at BCU
BA THESIS DEVELOPMENT A.Y. 2016/17	5 months	43	6 months	none	BA Thesis development at Politecnico di Milano
FEEL THE YARN 2017	4 months	2	6 months	Pecci Filati Filippucci	International contest
KNIT GAME Loro Piana 2017	3 months	2	6 months	Loro Piana	International contest

Fig. 5 – Comparative summary of the experimental activities.

Findings

This part of the investigation impacted on the research process in many ways.

First, it allowed to assess, develop, adjust and refine the designed methodological framework in an iterative process and to define it as the first outcome of this study, structured on three tracks (fig. 6).

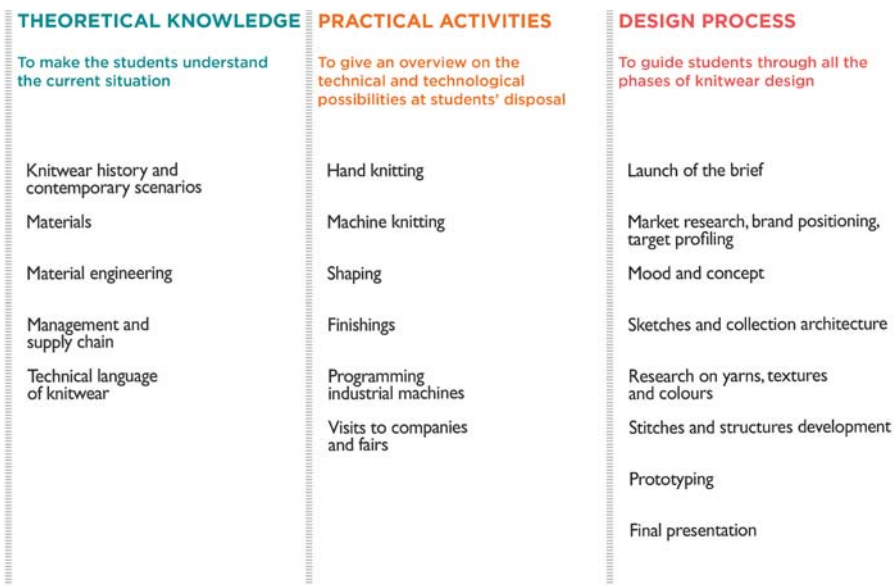


Fig. 6 – Tracks and modules composing the ideal formative experience for KD.

Second, it confirmed RH1¹, since the more effective experiences turned out to be the ones with a higher level of technical knowledge, always in line with that of design culture. The theoretical knowledge acquired through lectures and other traditional methods (T1) and the technical and experiential knowledge gained through hands-on activities (T2) had in all the cases direct impact on the way participants addressed the process of KD (T3) (fig. 7).

Third, it was useful to understand how the teaching activities could be modelled **on times, contexts and participant's target**, following the framework that had been designed as flexible, modular and adaptive to the needs of participants.

¹ RH1: In knitwear design there can be no creation without a technical background.

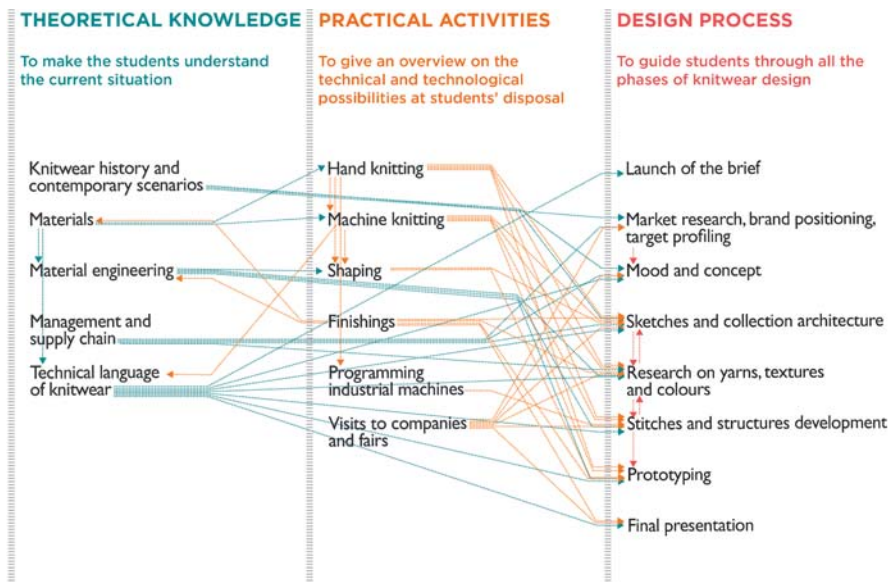


Fig. 7 – Arrows highlight the impact of each teaching module of Track 1 and 2 on the design process in Track 3.

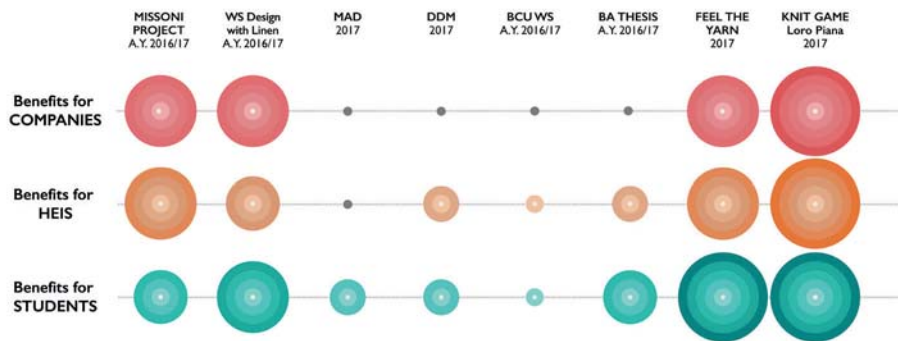


Fig. 8 – Visual synthesis of the benefits for students, HEIs and companies in each experimental activity.

Fourth, it contributed to verifying RH2², since the analysis of the benefits – taken on multiple levels and for all the categories of people involved – showed the activities with more than one type of stakeholder engaged in

² RH2: Innovative ways of relationships between university and industry are a facilitating asset to effectively answer the emerging needs of the knitwear industry.

teaching at one time to be more effective (fig. 8) and highlighted the positive impact of this involvement on several areas of knowledge. Students *learn by doing* (Dewey, 1938) and by experiencing reality, dialoguing with experts, being immersed in real situation.

Experimental Phase 2 (EP2)

Given the first results of the participation of companies in the teaching activities and having outlined the recognised additional value of their contribution to diverse areas of knowledge, EP2 aimed to improve these added values with the experimentation of good practices of collaborative teaching, taking advantage of the variety of stakeholders throughout the chain. This phase consisted of four more pilot training activities diversified by number of participants, participants' backgrounds, setting, duration and applied solutions (fig. 9).

	TIME	n° OF PARTICIPANTS	BACKGROUND IN KD	COMPANIES INVOLVED	SETTING
WORKSHOP Ghioldi	2 months	46	5 months	Ghioldi	3rd year curricular workshop at Politecnico di Milano
WORKSHOP Filoscozia	3 months	40	5 months	Filoscozia Filmar and others	Extra curricular workshop at Politecnico di Milano
DDM 2018	8 weeks	8	varied	The Woolmark Company CELC MFI	Post Graduate specialization course at POLI.design
BA THESIS DEVELOPMENT with Ghioldi	3 months	8	6 months	Ghioldi	BA Thesis development at Politecnico di Milano

Fig. 9 – Summary of the features of pilot activities conducted during EP2.

The intent was to test good practices and codify new guidelines to be applied together with the didactic modules in the framework, going beyond the most common practices of sponsorships, traineeships, contests, and brief workshops.

As all the previous phases of research highlighted some shortcomings for the already existing collaborations, each one of the detected issues had an assumed answer to be tested during the pilots (fig. 10).

EP2 confirmed, with a verified growth of benefits, the strength of collaborative teaching and outlined it as a unique opportunity for researchers and professors to address state-of-the-art topics and to gather benefits on multiple sides.

Consequently, the assumed experimental answers became a set of guidelines (fig. 11) for collaborative teaching that provide HEIs with the ability to answer the needs of the industry by improving students' learning, giving them, at the same time, the opportunity to apply the theoretical and technical basis they have learned on a real problem-based context, to gain an industrial mind-set and the ability to entertain a direct dialogue with stakeholders, to frame the industrial reality and to know it in all its steps.

ACTUAL SHORTCOMINGS	EXPERIMENTAL ANSWERS
Short time dedicated by the company to the students	Longer times
Briefs which simulate reality but are not actually real	Reality-based brief addressing the real needs of the company
Lessons held inside classrooms or workshops with inadequate facilities	Students immersed in the industrial environment to develop part of their work
Loose relationship and few meetings with the experts from the company	Constant feedbacks from companies on design and product development
Exclusive dialogue with the design units, with no contact for students with the other stakeholders along the chain	Closeness to manufacture with the involvement of diverse stakeholders
Lack of technical knowledge transferred, due to a preference for the creative side of the project	Collaborative development of student's projects with expert technicians inside companies
Difficulty for companies to understand and reach concrete benefits that they could exploit on everyday work life	Pursuing of concrete benefits for the companies as well as for students

Fig. 10 – Summary of the actual shortcomings of cooperation between the industry and HEIs in the field of KD, with the corresponding answers tested in the pilot activities

Guidelines:

- are designed to be selected and to model cooperation from time to time, depending on the concrete need of the involved company, the background of participants and the expected results.
- consider the reality-based needs of a company in terms of time, spaces, facilities and not just in terms of ideas.
- actively involve all the participants in teaching/learning.
- direct researchers and professors in HEIs on how to know where to intervene from time to time on the collaborative teaching approach and how to model it as required by the current situation.

GUIDELINES		STUDENTS	HEIs staff	COMPANY
PROPOSE	Gain the ability to welcome and give prompt response to reality-based brief which address a need expressed by the involved company			
	Act to reach concrete benefits for students, researchers and professors in HEIs and companies			
FACILITATE	Organize longer teaching experiences to respect the availability of the company's professionals and to allow their real and constructive participation			
	Schedule constant feedbacks from diverse professional figures on design, research, technical choices			
BUILD	Immerse students in the industrial environment through visits and lectures with professionals but also through having them working on their projects inside the company			
	Give a closer overview on the professional opportunities of manufacture, with the involvement of different stakeholders			
	Give students the opportunity to be hands-on on their projects and to realize prototypes under the supervision of teachers at the university, and under the guidance of technical experts inside the company			

LEGEND		
	Main responsible of the action	
	With active role in the action	
	Main beneficiary/ies of the action	

Fig. 11 – Summary of the guidelines.

Outcomes

Complementary Application of the Outcomes in an Integrated Teaching Strategy

The two final outcomes – framework and guidelines – impact on each other and are designed as modular and combinable, intended to be used together in an integrated and mouldable teaching strategy. The two components can be combined depending on variables such as the number of students, their background, the type of companies involved and their needs, the setting and the available time.

This kind of flexibility comes from the modular structure of both the framework and the set of guidelines: the framework is indeed composed of three tracks of knowledge which are not intended to be consecutive in terms of time but could overlap and be pursued in parallel. Similarly, the three groups of guidelines are non-consequent and are not required to all be present in each experience. The integrated strategy can thus be represented as a

composition of smaller modules which can be chosen to model each teaching activity depending on the situation (fig. 12).

The strategy is intended to become the backbone of a discipline that makes HEIs able to understand the practical needs of the knitwear industry and to translate them into educational experiences. It should provide teachers – professors and researchers – with the tools to be able to foresee the expected result of the teaching activity, and to manage it from a methodological point of view and make it as effective as possible. This means that, depending on the request made by stakeholder/s, professors and researchers can undertake an activity of an entrepreneurial nature, using teaching as a tool for assessment and choosing the most suitable methods and their application towards the desired result, while remaining in line with the students’ backgrounds and the available time and facilities.

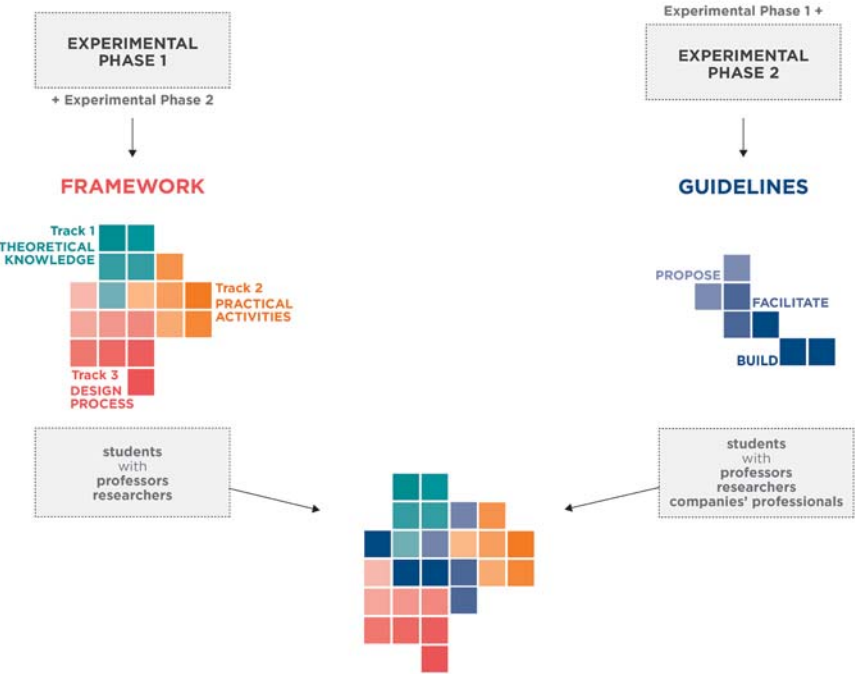


Fig. 12 – Visualization of the integration of the framework and the guidelines in a flexible strategy.

Conclusions

The study provides a framework of the Italian knitwear industry in its entirety, highlighting its specifics and critical issues as a particular branch of the fashion system. It approaches the knitwear industry from the domain of design studies, posing several questions, focusing, on the one hand, on the role that academic research in design and design education should play in such a context and, on the other, on who a specifically trained knitwear designer is, what competencies he/she should have, where his/her intervention is essential on the production chain.

All these issues have been defined in three initial research questions, addressed along the research development.

The undertaken investigation on the knitwear industry fully answered **RQ1**, highlighting the expressed need of a specific teaching approach for KD with dedicated tools and methods. The preliminary parallel investigation led to the framework for KD teaching, that through the tests conducted during Experimental Phase 1 answered **RQ2** with the definition of the competencies to be transferred to knitwear designers as linked to creativity and technique, composed by a multifaceted knowledge. This knowledge includes the learning of theory and practice about materials, material engineering, management, contemporary culture of fashion, production, manufacture, knitting techniques, software, and the ability to apply all this background to the phases of a design-driven creative process.

RQ3, is addressed by both the experimental phases of the research, with the design of the teaching strategy which is structured to deliver the needed competences but allows at the same time to pursue the training of knitwear designers with a very adaptable didactic approach, to be adjusted from time to time to the context.

With the reached answers to the research questions, the final outcomes of the study impact on a variety of areas:

- on the project, with reality-based project briefs, and a design process that becomes more strongly oriented towards the industrial product.
- on academic research, as for the first time, knitwear has been investigated in depth, among the academic areas of fashion design, as a discipline that deserves a specific training and a particular form of university research.
- on design education, where knitwear becomes a structured discipline among the other specialties of fashion design, with a set of specific

tools and methods and the deep connection with the industrial fabric that the relevant research aims to pursue. The knitwear designer will be a professional figure able to answer the specific needs of the industry.

As a starting point for academic research in the field of KD, this study paves the way towards several opportunities for future works. If, on the one side, the territorial boundaries set at the beginning gave the study a fertile ground of experimentation due to the specific features of the Italian context, on the other this represents a challenging issue to be addressed in terms of scalability and opens the door to several opportunities for future research, oriented towards the creation and codification of collaborative teaching experiences between international partners.

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Collaborative Processes Enabled by Design

Design as enabling agent. Design culture and non-designers in the changing role of disciplines

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Abstract

The network society and accelerating AI have changed the ways things work. In order to keep up with innovation and ‘survive’ this change, the academy is forced to dissolve disciplinary boundaries, while traditional professions are forced to rethink their roles. The world is in transition, characterized by the continuous need of re-definition of skills and ways of thinking. It is argued that design-related skill-sets are -inter -anti disciplinary and the most relevant for dealing with complexity and rapid change. Three such skill-sets are associated to design: **(1) Design Thinking skills; (2) Thinking Wrong personal qualities; (3) Future Thinking Principles**, all together in this research labeled as **Future Personal Characteristics – FPC’s**. According to different authors, design culture (D-culture) play a significant role in transferring the capital of designers to broad society (non-designers), while experience is recognized as one of the most effective ways in developing abilities and skills.

This research investigates the primary assumption that D-culture experience can influence non-designers in developing FPC’s. Qualitative and quantitative research methods are applied in order to find out how D-culture experience influence non-designers in improving FPC’s, which FPC’s are most influenced, and what relation is present between experience on D-Culture and improvement of FPC’s among non-designers. The research findings demonstrate that most FPC’s tend to be influenced positively by D-culture experience – some of them demonstrate a highly significant change. The findings can be presented to authorities, universities, and organizations within non-designer environments in order to stimulate the social impact of D-culture on non-designers locally.

New world - new roles

The Internet and network society has changed the way we work, communicate, perceive an experience time and space (Castells, 2011). Complex and unpredictable issues of life make it impossible for any single discipline to plan and implement solutions (Klein, 1990). Therefore, academic disciplines are challenged to cross their discipline boundaries in order to keep up with innovation and the traditional professions have to adapt to the “commoditization of work,” influenced by accelerating AI (Susskind and Susskind, 2015). According to the World Economic Forum – WEF (2017), one of the main effects of the fourth industrial revolution is **disruption to jobs and skills**. The roles, tasks, and activities for which human beings will be required in a post-professional society are changing. Different authors name the ‘probable roles’ for the near future among which only a few are recognizable: **para-professionals, empathizers, knowledge engineers, process analysts, moderators, data scientists, trainers, explainers, sustainers**, among them, also – **designers** (Susskind and Susskind, 2015; Daugherty and Wilson, 2018).

According to the analysis by Nesta¹ - Creative, digital, design and engineering occupations will all experience higher demand for their services by 2030, (Bakhshia, 2018).

New roles require new skills. Frey and Osborne mention Creative intelligence tasks and Social intelligence tasks among likely non-technically substitutable tasks by AI – the “bottlenecks”. Authors argue that for people to win the race, it is important to acquire **creative and social skills**. WEF argues that by 2020, more than a third of the currently desired core skill-sets of will be comprised of skills that are not yet considered as most important today but are growing fast: **creativity, complex problem solving, critical thinking, emotional intelligence** (World Economic Forum, 2017). The society is changing as well. The shift to a knowledge-based economy has placed greater emphasis on **knowledge as the main asset** (Drucker, 2012). The post-capitalist and network society, imply new ways of working and doing business (Cohen, 2017). **Collaborative sustainable society nodes are emerging**, but it will have the possibility to flourish only if developed appropriate self-regulation and self-organization – “a sustainable way” (Taylor and Taylor, 2007; Manzini, 2015).

¹ Nesta - National Endowment for Science, Technology and the Arts, and innovation foundation based in the UK. www.nesta.org.uk.

Democratizing knowledge. Anti-disciplinary rules

Knowledge is the main asset in post-industrial knowledge society it also bounds academic disciplines and professions. Susskind and Susskind (2015) highlight that academic disciplines and professions – the ‘knowledge gatekeepers,’ enjoy working on their own excluding from knowledge non-professionals, so-called ‘lay people.’

It happens because **knowledge besides its primary purpose of ‘truth-seeking’ is also related to power and authority** (Abbott, 1988; Muller and Young, 2014). Philosopher Foucault was one of the first to describe the discipline as a “system of control in the production of discourse” (Foucault, 1979) and “to discipline” as the complex set of strategies aimed to control. This type of control has come to dominate much of our modern life.

Foucault also mentions **anti-disciplinary** rights (democratizing the rights of the governed), in this way emphasizing the anti-democratic and authoritarian roots of the ‘discipline’. Many other authors describe disciplines and professions as ‘differentiationist’, undemocratic, etc. (Gieryn, 1999; Beegan and Atkinson, 2008; Shinn, 2002; Dubois, 2016).

Today other authors discuss the term ‘antidisciplinarity’. Joi Ito (2014) describes the approach to research in MIT Media Lab² as an antidisciplinary one. The antidisciplinary feature is the main requirement for applicants to MIT Media Lab and the only way to keep up with innovation.

Crouch (2013) notes that the term “is mentioned also in Darwin’s theory – although Darwinian theory is primarily biological since biology is the ‘antidiscipline’ of the social sciences [...] the theory is also profoundly behavioral. Over the past 150 years, Darwinian researchers have been able to develop explanations for the behavior of life on earth, including highly complex social behavior, such as one finds in bee colonies and, of course, in human society” (Crouch, 2013).

Suchman (2013) argues “[a]s a development project within the imaginaries of the knowledge economy, making useful knowledge seems even to imply less interdisciplinarity and more antidisciplinarity” (Suchman, 2013).

² “The *MIT Media Lab* is an interdisciplinary research lab that encourages the unconventional mixing and matching of seemingly disparate research areas.[...] The Media Lab’s antidisciplinary research community is uniquely equipped to address these concerns, leveraging the best that technology has to offer, and connecting technology back to the social and the human”. Source: www.media.mit.edu

The transition

According to Manzini (2015), the world is in a continuous transition, characterized by the continuous need of re-definition of skills. As argued by WEF, “[t]he Fourth Industrial Revolution is about more than just technology-driven change; it is an opportunity to help everyone, including leaders, policy-makers, and people from all income groups and nations, to harness converging technologies in order to create an **inclusive, human-centered future**” (World Economic Forum, 2017). On the other hand, The Fourth Industrial Revolution is about creating inequality. The technological development seems to be favoring first the strongest ones, and the most vulnerable parts of society are threatened to be left out because of the lack of ability to adapt. In this situation it is crucial to develop personal characteristics – ‘**the ways of knowing**’, enabling people within society individually manage the possibilities and threats generated by technological development, i.e., become more self-regulated and self-organized. By doing so, there is a chance **for sustainable ways of living to emerge** (Manzini, 2015).

Future Personal Characteristics – FPC’s

Within different bodies of literature, design is described as an interdisciplinary field. Designers can face critical issues that don’t fit neatly into one discipline (Ito, 2014). In the past ten years design has developed global recognition as an ‘agent of change’ thanks to the diffusion of Design Thinking (Brown, 2008; 2009). Design is human-centered (Brown, 2009) and designers are characterized by the skill-set potential for nearest future identified by WEF: creativity, complex problem solving, critical thinking, and emotional and social intelligence. **The design-thinkers personality profile** described by different authors (Brown, 2008; Curedale, 2013) combines an extensive list of skills and personal characteristics. Among the most frequently mentioned: *Empathy, Integrative thinking, Optimism, Experimentalism, Collaboration, Curiosity, Prototyping, Team oriented, T-shaped, Convergent & Divergent thinking, Ability to implement, Ability to visualize, Ability to learn from failure*. Other authors introduce new ways of thinking that encompass skill-sets, personal qualities and ways of thinking that enable people to think and act differently than it is set in the current mindsets. Among them are: (i) **Future thinking principles** described by Ito and Howe (2016) – ten core principles that “[...] offer a blueprint for how to shape the new world, and to thrive” (Ito and Howe, 2016): (1) *Emergence over Authority*; (2) *Pull*

over Push; (3) *Compasses over Maps*; (4) *Risk over Safety*; (5) *Disobedience over Compliance*; (6) *Practice over Theory*; (7) *Diversity over Ability*; (8) *Resilience over Strength*; (9) *Systems over Objects*; (10) *Learning over Education*; (ii) **Think Wrong** introduced by Galle *et al.* (2016), a “[...] radical problem-solving-system that reliably produces surprising, ingenious answers to your most wicked questions” (Galle *et al.*, 2016). Authors discuss the ‘status quo’ as the biggest our challenge for moving forward with the solutions and ‘work that matters’. There are six Think Wrong practices, each composed of three personal qualities: (1) *Be Bold – courageous, idealistic, challenging*; (2) *Get Out – adventurous, attentive, receptive*; (3) *Let Go – uncensored, crazy, prolific*; (4) *Make Stuff – Collaborative, Ingenious, Simple*; (5) *Bet Small – curious, experimental, thrifty*; (6) *Move Fast – open, confident, united*. It is noticeable that the mentioned skill-sets encompass the nature of design. Moreover, all of the mentioned: Design Thinking, Think Wrong and Future Thinking Principles aligns with the interdisciplinary profile described by Klein (1990). Later on, this study all the mentioned thinking principles skills and personal qualities are called **Future Personal Characteristics – FPC’s**. The question remains, which are the best ways to transfer these FPC’s at a large scale. Bruce Mau in his book *Massive Change* (2004), discuss the sense of design culture (D-culture) towards future global change – “[...] objects and techniques that are transforming our lives” (Mau and Leonard, 2004). D-culture is defined as ‘agency’ that may be appropriated into attempts to reform the aims, practices, and effects of design towards “greater and more direct social and environmental benefit” (Julier, 2014). Manzini and Bertola (2004) argue that projects on D-culture can play a significant role in transferring the enduring capital of designers to the broad society (i.e., non-designers). According to Bruner and Olson (1973), the experience is one of the most effective ways in gaining the abilities and skills among human-beings. Authors also state that “[...] culture and experience were both ignored as possible candidates to account for their development, [...] making [education] a poor instrument for the attainment of those important effects” (Bruner and Olson, 1973, p. 21).

Research question, aims & contribution

Referring to the described above, the research aims to investigate how and to what extent D-Culture experience works in developing non-designer FPC’s. More in detail the goals are to understand (1) which D-culture features might generate influential experience for developing non-designer’s

FPC's; (2) which FPC's are most influenced; and (3) what relation is present between non-designers experience on D-Culture and the development of their FPC's. Specifically, the research aims to: (1) implement a project on D-culture within the chosen non-design environment, involving non-designers within the D-culture experience. (2) Evaluate D-culture experience effects on non-designers FPC's. The research contributes to existing knowledge by providing evidence on the D-culture effects on non-designers. Results can contribute to legitimizing D-culture impact on social innovation within non-designer environments.

Research methodology

The research methods adopted in this study are mixed – qualitative and quantitative with the exploratory objective. Two research methods are adopted: (1) Case Study and (2) Action Research method. *A case study* is an ideal methodology when a holistic, in-depth investigation is needed (Feagin *et al.*, 1991; Gummesson, 1991). The primary motivation for action research is the practitioner researcher's '[...] felt need to initiate change' (Elliott, 1991, p. 53). The action research intervention is performed within a real-life situation for a period during which the observations are collected; it is an iterative process, the findings are brought back directly into practice with the aim to make a change (Elden and Chisholm, 1993).

Case study

In this research, a case study research method served to understand how a project on D-culture works in this way providing data for action research intervention. The selection of the case was determined according to the following criteria: (1) the case should represent the cultural organization or project with a strong historical background in design, (2) the organization/project should be focused on D-culture, and its diffusion to broad society as a core value. Eight study visits to creative, cultural organizations and projects were made in order to find the best suitable case. Comparing the organizations visited, the DesignLibrary³, a cultural community-based project on

³ DesignLibrary is the first library entirely dedicated to design that was established in Milan in April 2006 in occasion of Milan Design Week, in collaboration with Electrolux and patronage of ADI (Industrial Design Association). Other two branches later opened in Shanghai (2007) and Istanbul (2009). Source: DesignLibrary official documentation.

D-culture based in Milan, Italy, met best the requirement criteria mentioned above: (1) DesignLibrary hosts one of the most significant archive dedicated to design in Italy, i.e., has a strong historical background in design; (2) it is a community-based project on D-culture, which deliver an exceptional D-culture experience; the mission of the project is to diffuse D-culture to a broad international community. (3) DesignLibrary demonstrates a significantly higher focus on D-culture, comparing to other organizations visited. The collection and analysis of the data for the case study started in 2014 and ended in 2016. The data include Interviews with project representatives, official project documentation, researcher's gathered data from direct observation (notes, photographs), project website. The narrative framework is used around which the case study is organized. The data analysis follows four logical categories: *Development*; *Structural arrangements*; *Cultural process – activities*; *Benefits & challenges*.

Organized in such manner the case study provides an intricate understanding and describes the DL model to be implemented as the action research project within a chosen non-design environment.

Action research

The project DesignLibrary Kaunas (DLK)⁴ was developed as an action research intervention in a non-designer environment, during which non-designers are exposed to D-Culture experience for some time. DLK project is implemented starting from 2015, by replicating the model of DesignLibrary (DL) defined in the case study. The intervention location is provided by Kaunas University of Technology (KTU), the project is located in KTU research & business center 'Santaka' Valley⁵. The DL model is based on the membership model. Therefore, people willing to participate in DLK cultural activities have to purchase a yearly DLK membership. The membership fee is low but always applied. The members choose to participate or not in the program by their own choice, the project is communicated by randomly distributed campaigns. According to DLK data of June 2018, there are **312 individual mem-**

⁴ DesignLibrary Kaunas is the fourth branch of DesignLibrary network opened in Kaunas, Lithuania in 2016.

⁵ Science and business valley 'Santaka' is located in Kaunas, Lithuania and managed by Kaunas University of Technology. The valley aims to carry out interdisciplinary scientific and applied research. Source: www.santakosslenis.lt/en/

bers associated with DLK project. The bigger part of members are women (66%) and 34% are men. Members fall into 5 different disciplinary categories: Design & Architecture – 24%, Culture & Arts – 9%, Engineering & Technology – 17%, Business & Management – 24%, Other – 26%. The later section combines different fields that were not significant enough by number to form a representative group of one discipline. Among them are healthcare, food, sports and other. DLK project is held in Kaunas – the second bigger city in Lithuania (after Vilnius, the capital of Lithuania). The bigger part of the members are from Kaunas 63%, then 10% from Vilnius and 27% from other smaller cities of Lithuania. Events ‘**Design Thursdays**’ (DT) are the main activities that generate D-Culture experience in DLK project. The DT events are organized by involving design experts and trained moderators and people from other disciplines as speakers sharing a stage with designers. The DT topics are selected by relating design with other disciplines in order to gain interest from non-designers. 22 DT events were organized in the period of 33 months (October 2015 – June 2018). The data about non-designers D-Culture experience and its effects on the development of their FPC’s were collected during the DLK project intervention performing **DLK enquiry divided into two parts: (1) interviews** – qualitative; **(2) survey** – quantitative. **Interviews** were conducted in June 2018 at DLK, Barsausko str. 59, Kaunas, Lithuania, 15 participants, DLK members were reached. Respondents are interviewed individually in the English language. The design of the used semi-structured Interview consists of 4 thematic topics: 1) personal information & relationship with DLK; 2) design knowledge; 3) experience on D-culture; 4) future thinking. The strategy of thematic coding is employed accordingly in order to analyze these four thematic sections. **The survey** is conducted in July 2018. The online questionnaire is chosen as a tool to collect data for the survey. The non-random convenience sample is selected. The questionnaire was sent by email and DLK project newsletter to 312 DLK members and additional 1192 contacts subscribed to the DLK newsletter. The answers were gathered following four sections of the questionnaire: 1) Personal information & knowledge on design; 2) Professional field (discipline) and personal performance work-wise; 3) Involvement in DLK activities; 4) Personal skills, qualities and ways of thinking (FPC’s). 127 designers and non-designers filled the Internet questionnaire. In this research, only non-designer responses were used (93,7%), so the data related to designers (6,3%) were dropped-out initially leaving a sample of N = 119 respondents as scope. The descriptive statistics showed the majority of respondents were females (63%). Concerning age groups, the respondents within a range of 30-45 years were a dominant group (42,9%). The distribution by age, in fact, is consistent as there are at least

20% of the sample in each group meaning the survey covers various contingent. The distribution by professional field participants is inclined towards Engineers & Technology specialists (29,4%) and Business & Management specialists (26%). Interesting to note that more than 20% of respondents are from other fields which are not specified in this research.

In contrast, the minority of respondents works in Culture & Arts and Engineering & Technology field. Combined these respondents cover about 20% of the research sample. Survey participants are clustered into two clusters by the involvement level in DLK as the research objective is to compare the effect of D-culture experience between different groups by involvement in DLK. Therefore K-means cluster analysis was conducted to extract two clusters. Cluster analysis results suggest the division of respondents in two clusters. The first cluster consists of 65 (54,6%) respondents (High involvement in DLK) and the second – 54 (45,4%) respondents (Low involvement in DLK). The statistical analysis methods Descriptive statistics, Cronbach's Alpha, Kolmogorov – Smirnov test for normality, Independent samples (2 samples), Mann – Whitney test are applied for survey data analysis. The results of qualitative and quantitative DLK enquiry results are triangulated and summarized providing final research conclusions.

Findings and Conclusion

The research findings on (i) D-culture experience features and (ii) non-designers FPC's affected by D-culture are organized within three levels according to the level of influence: **(1) Very high; (2) High; (3) Moderate.**

Very high D-Culture influence.

The research results show that: D-culture experience let non-designers significantly develop the following FPC's: *Confidence, Collaboration, Team orientation, Integrative thinking*. The following let non-designers to adopt three future thinking principles: *Emergence over Authority, Practice over Theory, Learning over Education*. Most important D-culture features influence the development of all mentioned FPC's: *Listening to Designer's stories and Discussing on design practices*.

High D-Culture influence.

D-culture experience demonstrates to be influential also on developing *Convergent and divergent thinking*, enable non-designers in *Prototyping and Experimentation*, let them become more *Ingenious and Challenging*. The fol-

lowing let non-designers to adopt three future thinking principles: *Risk over Safety and Pull over Push* future thinking principles. The D-culture effects on these FPC's are less evident but anyway remains quite strong. The listed FPC's are influenced by *Analyzing design artifacts & prototypes, Staying in design-intensive environments, Reading books and Interacting with designers.*

Moderate D-Culture influence.

FPC's: *Empathy, Optimism, Curiosity, T-shaped, Ability to visualize, Ability to implement and being Attentive, Simple, Receptive, Prolific, Adventurous, Courageous, United, Uncensored* as well as the understanding of *Disobedience over Compliance, Systems over Objects, Resilience over Strength* future thinking principles are moderate and could be developed through Co-creating activities and Online activities over more extended period of time.

Generally, D-culture experience also let non-designers develop *a general understanding of D-Culture, and influences to think and act differently*, while the development of design knowledge is moderate and can be developed over a more extended period. Finally, the research findings let to conclude that *D-culture experience influence significantly non-designer's satisfaction with their work*, while the ability to manage the changes workwise is influenced strongly among women, men do not show significant results. D-culture experience to be significantly influential also on men ability to deal with challenging work environments the experience itself should encompass additional specifically tailored D-culture features. The following research results can be presented to non-designer environment stakeholders (universities, associations, and governments) in order to encourage policies towards legitimizing D-culture as an essential factor for social innovation in non-designer environments.

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Designing the empathic experience. Suggestions from art practices

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Abstract

The emerging collaborative approaches to design require a rethinking of how empathy as a designer's skill to step into the other's shoes is traditionally considered. Empathy should be extended to participants who cooperate towards a common goal. A shift from considering empathy as an individual's psychological ability to experience supporting dialogic and cooperative relations could be a better fit for collaborative processes. In order to achieve this change of perspective, a theoretical framework has been built up from a phenomenological account of empathy, focused on empathy's nature of interpersonal experience, introducing others into one's own personal horizon and enabling the acknowledgment of otherness. Empathy may unfold spontaneously within relational contexts, while still requiring its facilitation and support in addition to contextual circumstances which simply do not prevent it from occurring.

Hence, this study aims to provide guidelines that support the design of particular conditions for enabling empathic experiences. The guidelines for designing the empathic experience have been drawn from a study of participatory and collaborative art practices, since they are associated with creating particular relational contexts in which empathic experiences are triggered. Art practices – immersive, collaborative and/or participatory – are analysed with the aim of understanding how they can suggest strategies to designers. This cross-disciplinary work channels philosophy and art into the current design discourse, in an attempt to translate theoretical reflections about empathy and our modes of experiencing those around us into practical suggestions for facilitating collaborative processes and managing the relational dynamics at stake therein.

Introduction

By unpacking the title of the study, its main scope clearly emerges, i.e. to provide tools for *designing* ‘situations’ that enable *an empathic experience*. To this end, *suggestions* have been drawn *from contemporary art practices*.

The study is framed within a broader research topic regarding the possibility of rethinking the relationship between art and design today. The reason for reconsidering this relationship is that both disciplines are similarly involved in a long-lasting transformation that has ‘dematerialized’ objects and products towards processes and practices.

«The initial model of design has gradually been redefined, with successive additions generated by the need to widen its field of application (from products to services to organizations), to embrace new actors (from experts in other disciplines to end users), and to change relationships with time (from close-ended to open-ended processes)» (Manzini, 2015, p. 53).

Moreover, the role of artists and designers is becoming that of facilitators, strategists, activists, social agents; while the audience and users are becoming participants and co-designers. In the words of Claire Bishop (2012, p. 2), «The artist is conceived less as an individual producer of discrete objects than as a collaborator and producer of situations; the work of art as a finite, portable, commodifiable product is reconceived as an ongoing or long-term project with an unclear beginning and end; while the audience, previously conceived as a ‘viewer’ or ‘beholder’, is now repositioned as a co-producer or participant».

Given this similar development in the transformation of art and design, the assumption from which the study stems is that art can provide design with strategies for developing processes, along with inspiring aesthetic solutions as it has always done.

Conceptual framework

It’s worth clarifying the art and design I considered in this research. On both sides, this work is focused on current practices that put at their center the process of doing, making, experiencing something together, working towards a common goal. In short, processes and practices in which the emphasis is on collaboration and the collective dimension of social experience. With regards to art, under the umbrella of “relational and participatory art” I considered contemporary *practices* (not artworks) based on audience’s participatory experience and/or bodily engagement in the production and/or in

the reception. In the realm of design, I focused my attention on collaborative design *processes* (not products) that rely on dialogic exchanges and cooperative attitudes for a successful development.

Namely, participatory and collaborative approaches and practices, such as *relational* and *collaborative services* (Cipolla and Manzini, 2009), projects by *creative communities* (Meroni, 2007), *dialogic art* (Kester, 2011), *immersive life practices* (Tucker, 2014), which are all increasingly dependent on relational exchanges. Involving many participants, sometimes even communities at large, and multiple stakeholders in complex dynamics of cooperation, they must rely on relational skills and oiled relationships for their unfolding.

In this respect, Richard Sennet argues that making something together in view of a common goal requires the craft of cooperation, that is essentially based on dialogic skills. «Cooperation [is] a craft», he states, and «It requires the skill of understanding and responding to one another in order to act together» (Sennet, 2012, p. X). He also connects empathy with dialogic skills, for empathy attends to another person on his or her own terms, without trying to erase or overcome differences. In his words «the dialogic conversation prospers through empathy, the sentiment of curiosity about who other people are in themselves» (p. 23).

Following this line of thought, the study has been conducted through the lens of empathy, today responsible for building a bridge between art and design, considering that it may constitute a common ground between participatory and collaborative approaches that have recently emerged and that rely on dialogic and cooperative skills.

However, when speaking about empathy the risk of being misunderstood is very high. Empathy has become a buzzword over the last decades, including in the design discourse, usually taken superficially as a ‘soft skill’ associated with the capacity of putting yourself in the shoes of another. This study took on the challenge of rethinking empathy in design disciplines, with the aim of questioning its role and interpretation within collaborative processes based on cooperation.

Empathy in design literature

In structuring the study, a literature review has been fundamental. It showed that even though the topic of empathy in design is not new, it has undergone a season of great interest in the last ten years (Cipolla and Bartolo, 2014; Devecchi and Guerrini, 2017; Dong *et al.*, 2018; French and Teal, 2016; Kouprie and Visser, 2009; Mattelmäki *et al.*, 2014; Mattelmäki, 2018),

also confirmed by the presence of many papers on the subject at a number of important design conferences¹.

Highlights from the literature review report a general concern for updating the traditional tools and methods of empathic design in order to tackle the growing complexity of design practice. Primarily, the issue of scaling empathy from designers to participants and stakeholders recurs within the reviewed material. Along with the need for reconsidering empathy's role and position within the design process.

Furthermore, while reviewing the literature, what stood out was the almost absent account of empathy as a relational experience, while prevailing a traditional perspective on empathy as the designer's skill to walk in the shoes of his/her user, as a useful tool for gaining a deeper understanding of his/her needs and wishes.

In a nutshell, out of the review came that empathy in design is shifting:

- from affecting the user-designer relationship, to a broader group of participants;
- from a self-referential act of the designer addressed to the end-users' understanding, to a soft skill to be scaled and sustained within organizations and companies;
- from the individual ability to be used when designing, to experience enabled by 'situations' designed in view of the aim;
- from an approach adopted at the early stages of the design process, to the process itself spreading along the whole design intervention.

Thus, what clearly emerges is the need to question the notion of empathy in design and to reconsider it in order to draw out a more suitable way of accounting for how it tackles the relational issues involved in a design processes based on collaboration.

Empathy and its complex substance

Reconsidering empathy means first of all recognizing its complexity, its multi-layered substance which goes far beyond the ability of walking in another person's shoes.

¹ To name just a few: Cumulus Conference - *Design for everything*, Hong Kong 2016; 12th EAD Conference – *Design for Next*, Rome 2017; ServDes Conference – *Proof of concept*, Milano 2018.

«Empathy is a laboratory of lived and intellectual experiences woven into interpersonal relationships and social bonds», writes Laura Boella, one of the most engaged scholars in rediscovering empathy (2018, p. 11). She also states that «Empathy is never just singularly one thing, rather it follows various paths. It changes depending on different subjects and contexts and intertwines with a variety of affective and cognitive processes»² (p. 62).

The complexity of the notion of empathy is also due to its long history. Empathy finds its origin in *Einfühlung*, the German word meaning ‘feeling into’ used in the XIX Century philosophic tradition of Aesthetics to describe the way in which humans perceive objects (in particular artworks) projecting themselves into them. When Theodor Lipps extended the use of *Einfühlung* to the problem of consciousness of other minds, the concept of empathy (and the word, translated into English in 1909) made its way into psychology, phenomenology and – more recently – social neurosciences.

In order to provide the work with a theoretical background, the study explored the concept of empathy – especially its phenomenological account – in an attempt to return its complexity and bring it into the design discourse.

Empathy as a skill vs empathy as an experience

The typical concept of empathy as a skill, performed by designers for gaining insight into users’ needs, is proving to be unsuitable for handling the complexity of emerging collaborative approaches. On the other hand, empathy as a relational experience which enables the discovery of the other and his/her otherness, may be crucial in supporting collaborative processes that rely on cooperation and dialogic skills.

For shifting to such an experiential account of empathy the study called on an examination of the phenomenological tradition, with a particular focus on Edith Stein’s doctoral dissertation *The problem of empathy* (1917)³ and its recent interpretation by philosophers such as Dan Zahavi and Laura Boella, among others (Boella, 2006; 2018; Zahavi, 2010; 2014). According to the Steinian account, empathy is an intersubjective process in which two subjects connect and come to know each other, keeping their identity well separated. There is no identification, nor blurring of one’s self and the other. Rather, the discovery and acknowledgment of the other’s alterity.

² Translated into English by the author.

³ Consulted: Stein, W. (1921) *On the Problem of Empathy* (W. Stein, Trans.), Washington D.C.: ICS Publications.

Instead, in empathic design, and in design disciplines in general, empathy is usually understood in its psychological sense, which identifies the ability of taking the perspective of another person, thus walking in his/her shoes, overcoming differences towards a complete identification which allows a deep understanding of the other. Such a skill is considered innate, yet also learned. It can be enhanced and improved by specific exercises and techniques, which in fact are strongly suggested to empathic designers in order for them to better understand those for whom they are designing.

By contrast, empathy as an experience does not depend on an individual's attitude or training, rather it is built on the connection between a self and another established within a face-to-face encounter. It allows the discovery and acknowledgment of the other's existence in his/her terms, paving the road to deeper relational exchanges. As an experience, empathy may be enabled. This could mean that it may be possible to set the right conditions for it to occur, as to facilitate and support dialogic encounters and cooperative relationships.

Given that the experience of empathy may be enabled, and that experiencing empathy may have a positive impact on relational dynamics at stake in collaborative processes, the study's endeavour has been to understand how design might enable such an experience.

Enabling the experience of empathy

The second part of the study has been focused on answering this question, by means of the analysis of case studies aimed at exploring the possibilities of enabling an empathic experience.

At this point, I will take a step back to the assumption stressed in the introduction regarding the role of art practices in suggesting strategies for developing design processes. Thus, the study will seek among contemporary art practices a number of examples of empathic processes, deemed to be fitting with the phenomenological interpretation of empathy. Six case studies among immersive, participatory and/or collaborative practices, have been analysed by applying the theoretical framework of empathy as experience of the other, embodied, relational and multi-layered.

Art practices selected as case studies:

- belong to the 'crossover zone' (Perelli, 2017) between artistic, social, psychological and perceptual experiments, activists' initiatives and public events, which characterizes the landscape of contemporary art today;

- have been chosen within a timeframe going from pioneering participatory artworks to contemporary practices which have inherited an open-ended approach;
- set up “situations” in which embodied encounters happen and participants are asked to do something together;
- address a kind of experience which raises awareness of human interconnection and otherness as values;
- require somatic engagement, both mental and bodily.

The methodology for approaching such case studies included a preliminary desk research phase based on literature and personal observation from an historical-critical perspective. Subsequently, in order to verify that each case study was consistent with the main theoretical framework regarding the empathic experience, I sought to identify the conditions that in each case could be responsible for the empathic experience unfolding. There is room here to discuss just two of the six cases studied, and give an idea of the work involved.

Suggestions from art practices. 2 examples

On Space Time Foam – by Tomás Saraceno – has been showcased in 2012 at Hangar Bicocca in Milan. The installation is made of three layers of transparent membranes floating 20 metres above ground level. People walk on the membranes which are inflated with varying amounts of pressure between one and the other. At maximum inflation the membranes take the shape of a dome, with steep walls to climb. When someone on the ground level enters or exits the installation, the amount of pressure changes and the dome shape collapses. The transparent floor bends under people’s feet and continuously changes shape in relation to people’s movement. As the walls get steeper, people are required to coordinate their movements and their mutual spatial relations in order to gain control over the space.

As established in the methodologic approach, after the preliminary study of the artistic intervention, I assessed its consistency with regards to the features characterizing the empathic experience.

Out of the assessment came that *On Space Time Foam* could be read as a model of empathic experience for the following reasons:

- it generates an embodied relational experience;
- participants are immersed in a space together with strangers who they must reach out to and interact with;

- its effect depends on the presence of at least two people. One single person is not enough to trigger the transformation of the surrounding environment; it is essential to have at least one person on the membranes and one down on the ground in order to activate the difference of pressure;
- the experience provided by the installation can be considered an immediate experience, in the sense that it happens there-and-then, without any mediation, and in strong relation with the context set up;
- it addresses a somatic perception. It calls perceptual certainties into question. By walking upon a floating floor our kinaesthetic dimension is highly stimulated and required to intervene;
- the particular experience makes the interdependence of people's actions tangible. Each individual movement corresponds to a reaction of the whole environment. One portion of the floor goes down and another goes up, according to people's movement;
- to experience *On Space Time Foam* is very demanding in terms of active personal engagement. Although it sounds like a playful game, participants must be in the right disposition to collaborate in order to overcome such a challenging situation.

Another case study has been *Green Light* – by Olafur Eliasson (2016-on-going) – which shares some similarities with Saraceno's work with respect to the experience evoked in its attendees. *Green Light* consists of two interventions: a workshop engaging migrants in assembling modular lamps made from sustainable and recycled materials; and a parallel *Shared Learning Programme* providing migrants with an educational curriculum. It embraces forms of learning that create a multi-relational and collaborative processes of exchange. Activities include weekly theater gatherings, film screenings, seminars and workshops held by visiting artists; daily language classes, vocational training, legal consultancy, job training and psychological counselling. The author, Olafur Eliasson states his goals as follows: «How does one proceed from the assembly of a light module to social change? The journey might seem long and convoluted, yet a simple but crucial step is to trust the potential in the non-spectacular situation of sitting down together and doing something basic with our hands. [...] What emerges during these activities is a shared social space [and] a feeling of interconnectedness» (Eliasson, 2017, p. 14).

Once again, I assessed whether the *Green Light* experience might be considered one of an empathic kind:

- Participants are involved in the collaborative process of producing a tangible output, and to achieve this goal they are asked to engage in embodied interpersonal interactions, *Green Light* is *de facto* an embodied relational experience;
- Even though the project hosts up to forty participants, in assembling the elements of the lamp attendees are often paired up when working on a specific task;
- Participants are involved at different levels in an immersive experience. Hence, *Green Light* “talks” immediately – i.e. without any mediation – to its attendees;
- A somatic perception is called upon, or rather a somatic engagement, for instance with regards to the communication between people of different languages, which requires gestures and body language;
- From assembling lamps together, sharing food, learning from one another and with others, comes a deep sense of interpersonal connection.
- By activating a “we-mode” – according to which we are, metaphorically speaking, modules that, despite looking all the same, once recombined give shape to something else (Roepstorff, 2017) – *Green Light* achieves the goal of enhancing the interdependence of people’s actions.
- It is a very demanding experience in terms of active personal engagement, mostly for refugees and asylum seekers, but also for locals and volunteers who decide to get involved in the project.

Once the conditions enabling the empathic experience in each of the 6 case studies had been identified, I collected the recurring elements and theorized a system of so-called *enablers* of the empathic experience. A survey among participants at the case studies contributed to gathering their opinions about the experience they had been through and what condition they acknowledged as enabling it. By matching the case studies and the survey’s results, I deduced the 9 *enablers* of the empathic experience. Each *enabler* identifies a particular circumstance that may be acknowledged as triggering an experience of empathy. The *enablers* can be contextual, meaning that the context is set up with particular spatial and temporal conditions which favour bodily immersion into the proposed activity; and/or relational, meaning that the relational dynamics among participants are driven in a particular direction by intervening beforehand, by, for example, determining the number of participants, their previous relationships or their life circumstances (tab. 1).

Tab. 1 – The enablers of the empathic experience.

Art box	Contextual	The artistic context is usually perceived as a neutral zone with particular rules exiting from socio-economic constraints. Outside of the prejudices affecting everyday activities, participants are keen to establish equal interactions.
Tricky space	Contextual	The space may be set up with perceptual tricks that force participants to renegotiate their relationship with the surrounding environment, thus enhancing their awareness of the basic body-space connection.
Bracketing place	Contextual	A place ‘put in brackets’ is a neutral concrete space allowing particular ways of being together. It is a place where relationships are not yet commodified.
Suspended time	Contextual	A fracture in the ordinary unfolding of a typical day, allows for a moment of undivided attention, an attitude to listen and connect to the other.
Body to body	Relational	A basic condition for empathy is the interpersonal encounter. ‘Body to body’ stands as a pre-condition among the other enablers. It is a <i>conditio sine qua non</i> .
In your shoes	Relational	A situation in which participants are asked to switch their roles with someone else. The reversal of usual roles facilitates a change in one’s own perspective.
Common goal	Relational	Having a concrete objective to achieve together, puts participants in the condition of establishing a dialogue with others, and horizontal relations based on trust, openness and mutual help.
Foreign face	Relational	the different identity, socio-cultural background, and geographical provenance may convey otherness and diversity as valuable assets
In the same boat	Relational	Sharing a particular circumstance, be it negative or positive, enhances the feeling of togetherness. When we are ‘all in the same boat’ we are keener to acknowledge the other as someone very similar to us and feel in tune with him/her.

Results. Towards guidelines for designing the empathic experience

The last part of the study has been focused on interweaving theoretical reflections to formulate practical tools, in an effort to translate theory into practice.

A first step was a workshop I held at the Universidade de Aveiro⁴ aimed at discussing the proposed *enablers*. I invited 5 PhD researchers interested in design for social innovation, user experience and service design in order to figure out scenarios for the *enablers*' application within design processes. The agenda of the workshop included a presentation of the case studies and the *enablers*. Afterwards, participants discussed them and provided suggestions. They also worked on a double diamond model in order to identify the phases of the design process which are more likely to host a designed empathic experience and to what aim (Devecchi, 2017).

The outcome of the whole research process took the shape of a set of guidelines for designing the empathic experience, intended to help designers in developing, preparing and handling collaborative processes. As the word itself says, *guidelines* are intended to guide and in no way restrict. They are not rules. Rather they shall act as suggestions to design the best conditions for initiating the experience of empathy. In this respect, one must consider that, as in every experience, empathy may occur or it may not, depending on several factors, mainly related to one's own approach and sensitivity. However, when empathy unfolds, it may pave the path to dialogic relationships and cooperative attitudes, thus improving and fostering processes that rely on such relational dynamics.

Conclusion

The research journey started with reconsidering empathy's meaning and role in design, making it more suitable to emerging design practices. I considered that moving towards a phenomenological account of empathy as an experience of discovering the other and his/her alterity, may be an answer to the increasing need of managing the relational dynamics at stake in collaborative processes.

The journey went on to draw on collaborative/participatory art practices in order to isolate useful suggestions in view of strategies for enabling an

⁴ *Design for Empathy. A workshop*, Universidade de Aveiro, 4/07/2017.

empathic experience. In this respect I considered that «the arts and cultural projects in particular can create a level playing field to allow persons of different cultural backgrounds to interact, learn and experience on a par with each other» (European Agenda for Culture, 2017, p. 15).

The research journey ended up with the translation of these suggestions into a flexible set of guidelines aimed at structuring the best conditions for the experience of empathy to occur through collaborative processes.

It may seem to be a paradox, since empathy of course cannot be designed itself. In fact it is instead just enabled. What a designer can do is set the stage and be sure he/she is not impeding its unfolding.

The conclusions of the present study are open, in the sense that they call for a great potential of further development and discussion.

Weaving philosophy with theory and history of art into the design discourse is quite a novel approach and could be further discussed in a design arena in order to collect other opinions and feedback. It's even more important to question the practical outcome of the study – the guidelines – and to experiment its use in real collaborative design processes.

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Intermediate urban space. Design and light art as catalysts for change: participation beyond fruition

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Abstract

Many interventions in the world transform the urban space without considering the opinions and needs of the people involved daily in the dynamics of the city. In this context, the issue of participation has gained importance in several initiatives in the areas of art, architecture, design and the management of spaces, be they public, private, or both. The weight and the degrees of participation attributed to the various parties involved in the design process are, however, very debatable. The purpose of this study is to inspire the production of interventions in the urban space, which can, simultaneously, be closer to people's needs and offer aesthetic experiences for any kind of person. While referencing Light Art, Tactical Urbanism, and Design for Social Innovation, the research methodology encompasses case studies of interventions involving light; interviews with light artists; and a workshop with students of interior design. Case studies tend to encourage more participation of ordinary people in the early stages of the process. The interviews indicate a sort of openness to people's participation, more related to fruition. The workshop shows examples including such participation beyond fruition. The main contribution of this study is to shift the focus from the participation of ordinary people to the beginning of the design process, "the conception phase of the design process". Another contribution is to present and discuss the concept of "intermediate urban space", seeking to unite the physical and symbolic aspect into a single concept relative to the space of the urban experience.

Introduction

The thesis that originated this chapter is based on a broad and general motivation to try to unite, in participatory design processes, two types of knowledge: specialist and popular, in a seam that is always arduous and that accumulates many conflicting forces. One difficulty is trying to approach seemingly opposing and mutually repelling things. Another difficulty is not being able to naturally satisfy the various interests at stake when you test the experiences of consolidated practices.

Situated in the fields of Spatial Design and Light Art, this theoretical and applied research aims to identify a possibility of contribution by Light Art and Design to improve the quality of the urban experience, considering the involvement of ordinary people in the design process.

Many interventions in different parts of the world are often carried out in order to transform the urban space, without considering the opinions and needs of the people involved daily in the dynamics of the city. This limitation has a connection with the writings of Jane Jacobs (2001). In the 1960s, she called special attention to people's real needs, rather than those idealized only by specialists who, in many cases, overlook such needs. Design plays an important role in supporting the participation of the various actors interested in the restructuring processes of urban spaces. For this, it is necessary to be in tune with the new challenges of the Twenty-First Century.

As the intention here is not only to reduce the solutions to primary needs, the idea of working with the potential represented by light is precisely to make room for the dream, for the unusual, for the invisible. "Art challenges notions of identity, of belonging, and estrangement, and questions borders and the distribution of privilege, to mention only some of the things it is capable of doing" (Eliasson, 2017, p. 13). Several examples of Light Art show that light has the potential to activate the aesthetic experience of people in indoor or outdoor spaces. Considering the complexity involving the engagement of ordinary people in the design process, the choice of light as the central element of intervention can give potential to efforts aimed at activating the urban space, encouraging a more inclusive experience in the city. Here, light is a metaphor for the intermediate urban space, that space that is within the scope of the symbolic and of all the possibilities of bridges and connections that it entails.

Background knowledge

Challenges in times of neoliberalism

To begin with, space is not only a physical dimension (place, position). Space for me is inhabited. To inhabit is connected to habitus, with everyday life, with lived experience (Augé, 1994; de Certeau, 1998).

Discussions about living, empowerment, sense of belonging, and urban commons have become an imperative in the 21st century against policies of neoliberalism. Many cities and metropolitan centers have adopted neoliberal urban policies to address certain problems that we are daily subjected to, such as the deterioration or abandonment of an urban space, whether public or private, central or peripheral. Harvey (1996) and Mongin (2009) warn of this fact, of how some cities have adopted neoliberal strategies to interfere with the urban space, with the pretext of revitalization or urban renewal. In practice, neoliberal strategies applied to well-intentioned and creative urban initiatives intervene, many times, negatively in the city. Therefore, it is important to be attentive to ensure that such innovations are not captured by profit-focused principles (Campbell, 2015, pp. 28-31; Harvey, 2008).

Design has had an important role in this context (Manzini, 2016; Manzini, 2015; Cardozo, 2012). Various agents have been invoked to participate in the construction and restructuring of the urban space process, such as professionals, local communities, public and private bodies. The designer acts as one of the facilitators of such actions, and similar operations can be observed regarding artists, architects, and urban planners today. As said by the Brazilian artist Hélio Oiticica, we can understand “the artist not as a creator for contemplation but a motivator for creation” (Campbell, 2015, p. 7), and this is reiterated by the Danish-Icelandic artist Olafur Eliasson (Beccaria, 2013). This can also be observed in the field of tactical urbanism, where architects and urban planners play a role as guides in the creation process.

However, this role of facilitator or administrator of processes involving the participation of various agents can compromise the role of the designer as a creator, “where creative ideas and design culture tend to disappear”, as argued by Manzini (2015, p. 65), about the *participation-ism* in the *emerging design* practices.

Emerging design and tactics on a micropolitical scale

Emerging design

Manzini (2016) outlines a redefinition of design, aiming to add value to the specific skills and culture of design experts. The concept of design has changed to what he calls “emerging design: a problem-based, solution-oriented design, the defining characteristic of which is not the products, services, and communicative artifacts it produces, but the tools and methods it uses” (Manzini, 2016, p. 52). For him, emerging design could and should be the agent of change (cultural, social and environmental) in the 21st century society, but the absence of a debate in its cultural dimension prevents the full expression of its role in the contemporary world. This culture, at the heart of emerging design and identified by Manzini as “solution-ism” and “participation-ism” remains, therefore, both limited and limiting.

According to the author, emerging design has features that differ from those of traditional design theory and practice of the early 20th century, which saw design as an expert activity strongly connected with the industrial production and its idea of time. He points to three changes as evidence: the focus shifts from the design of “objects” toward “ways of thinking and doing”; design processes become co-design activities; and the term design expands, now having three different meanings (*diffuse design*, *expert design*, and *co-design*) (Manzini, 2016, p. 53). Regarding the co-design activities, it is fundamental to understand the different levels of participation.

Participation degrees

On an evaluation scale ranging from “non-participation” to “authentic participation”, Souza detects eight categories divided into three subgroups: “heteronomy”, which involves situations of “non-participation” and corresponds to the lowest range of categories (“coercion” and “manipulation”); “pseudo-participation”, represented by intermediate categories (“information”, “consultation” and “co-optation”); and “authentic participation”, represented by the highest-ranking categories of the scale (“partnership”, “empowerment” and “self-management”) (Souza, 2006, pp. 202-207, p. 389).

It is perceived that, in so-called participatory design processes (co-design), differentiation of the different degrees of participation are not always established, which I think is essential if we really want to engage in the generation of inclusive design processes. In other words, using the same partici-

patory design term for processes with such different degrees of participation may aggravate an already distorted focus from the main aspect that the term seeks to achieve. In my view, such a focus should be on at least the three highest degrees of the scale, i.e. the categories of ‘authentic participation’. One of the situations where one can observe the attempt to implement authentic participation is in the realm of tactical urbanism.

Tactical urbanism

Tactical Urbanism is a form of intervention in the urban space in which the architect and urban planner are usually inserted into a transdisciplinary team, which operates within a micropolitical scale and proposes restructuring, projects, and interventions that are very close to everyday realities.¹ The agents or actors, including users of spaces, participate more actively as protagonists in the practices and creation processes, where decisions are taken more horizontally (bottom-up) than in strategies of mainstream urbanism, which tend to be top-down oriented.

De Certeau’s (1998) thinking is fundamental in this issue of shifting the focus to a micropolitical scale, where bottom-up tactics become preponderant in relation to top-down strategies.

We could draw a parallel between Manzini’s considerations about emerging design – the difficulty to evaluate the results, reach, and sustainability of still relatively recent experiences – and the fields of architecture and urban planning, specifically tactical urbanism. There are several similarities in the procedures of emerging design and tactical urbanism since both seek to adopt, to a greater or lesser degree, the same approaches: user-centered design, participation of different stakeholders and actors, co-design and exchange of knowledge between experts and ordinary people. Is it possible to predict difference between them? Apparently, Manzini’s criticism would be less appropriate in many examples of tactical urbanism. This happens because the architect-artist-designer does not act as a mere facilitator of the process, but also as a creator who can reach thought-provoking results through an exchange of popular and expert knowledge, the boundaries of which are blurred.

Another aspect of tactical urbanism that can be highlighted is that the

¹ As examples, I would cite several projects by Alejandro Hayek, Santiago Cirugeda, Todo por la Praxis, and other groups.

technical, aesthetic, and innovative quality of the projects is relevant, unlike the usually negative expectations when the co-design effectively involves ordinary people, whose daily experiences are considered and affected. The expert continues to have a very active role both in conducting the creation process and in the creation itself. Here it would appear that the power balance follows a direction that tends to be more bottom-up than top-down. In this kind of approach, it is important to note that the results are naturally more fluid and open, for lack of a previous prescription that can pre-define them.

The concept of the intermediate urban space

By introducing the concept of “intermediate urban space” in this study, the idea is to construct a possibility of “neutral” and “porous” space to debate the paradox of the designer’s role today.

The intermediate urban space (IUS) is here defined as a part of the city fabric, an outdoor or indoor space that can be residual, degraded, marginal, central or peripheral, used or not, empty or not, populated or not, small or large, public, semi-public, or private. It has the property of being “in-between” in relation to different and characterized urban areas and/or cultures.² It is a physical or symbolic entity, often associated with conflicted areas in the city, with “no places”, as well as a terrain for as of yet open experimentation (figg. 1 and 2) (Tibúrcio, 2017b; Augé, 1994).

A good metaphor for the intermediate urban space is when two people who speak different languages wish to communicate through an intermediate option that brings references of both languages, mixing them up and creating a third possibility of communication that does not completely correspond to any of the languages.

The interesting thing to note is that communication happens, even if there are mistakes which, curiously, can collaborate a lot to better understanding one’s own language and that of the other. This new language, or dialect, if you will, has the property of providing comfort (by bringing familiar parts of the language itself) and discomfort (by bringing parts that are foreign to the language itself) to both interlocutors, placing them on equal footing. The beauty of all this is that the intermediate space built by the parties is enriched, while at the same time guided by a sort of neutrality.

² Related to this definition, see also the concept of In-between urban space in Piccinno and Lega (2012).

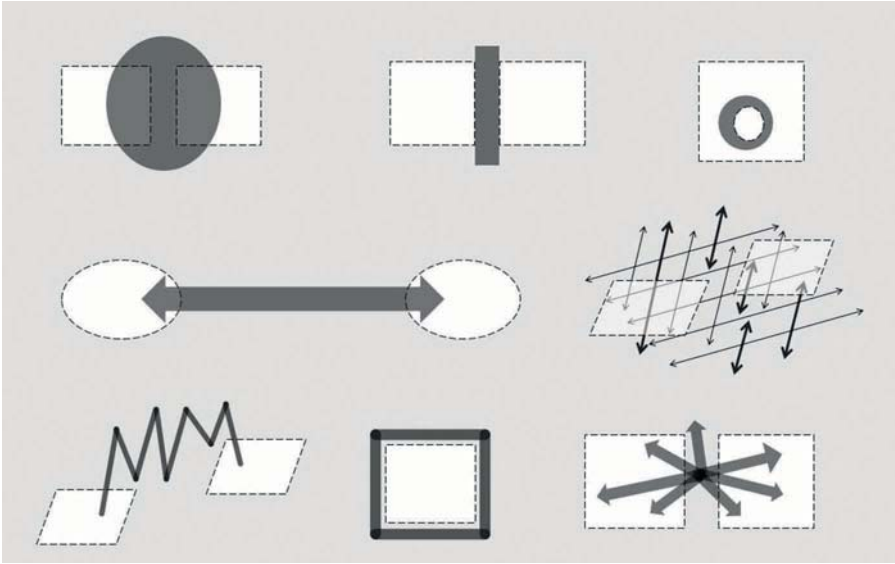


Fig. 1 – Intermediate Urban Space (IUS). Schematic diagrams. Author’s sketches, 2015.



Fig. 2 – IUS: Bovisa Station Parking. Milan. Source: Author’s archive, 2017.

Potential between light art and participation

Light art can provide transformation in the intermediate urban space with some kind of enchantment and displacement of common sense, because it has the ability to stimulate the perception of space, encouraging a more immediate, emotional and exciting experience in it. The way the artists James Turrell, Carlo Bernardini, and Olafur Eliasson use light to give expressiveness to space is quite impressive because sometimes the generated ambiences create states of such fantasy that it seems to plunge the viewer into a parallel reality, as if by magic:

Non è propriamente l'installazione a cambiare in funzione dello spazio, quanto invece l'opera a trasformare il luogo in cui si trova. Sono proprio gli aspetti non visibili che si possono leggere nel vuoto, a suggerire le nuove coordinate percettive. (Carlo Bernardini, in Tibúrcio, 2017c, p. 61)³

For example, the scenario of the historical and architectural landscape can, through art-design synergy, encourage more involving experiences by stimulating the creativity of the spectators and users themselves, who also benefit through this intuitive approach (fig. 3).

Another potentiality is how light interventions can stimulate an interaction between the viewer and the artwork, beyond fruition. The installation *Beauty* (Olafur Eliasson, 1993) is, according to Beccaria (2013), a key work to understand how the viewer is indispensable for the completion of Eliasson's art:

The perception of the rainbow and its colours depends on each viewer's position, since the optical phenomenon can only be seen when standing at a particular angle to the curtain of droplets, and disappears once one moves away. (Beccaria, 2013, p. 20)

Beccaria (2013) complements:

Moreover, *Beauty* can be considered in relation to Eliasson's engagement within the social sphere. He maintains that '*Beauty* is political' since, while not responding to any particular requisite, the work opens up a space of personal freedom, offering each visitor an experience of self-realisation. (Beccaria, 2013, p. 21)

³ "It is not exactly the installation that changes according to the space, but how the work transforms the place it is in. It is precisely the invisible aspects that can be read in the void, to suggest the new perceptive coordinates" (Carlo Bernardini, in Tibúrcio, 2017c, p. 61).

The transparent aspect also attracts a lot of attention in some Eliasson's works, since the artist literally exposes the components, the cables and feed-stocks of them. This allows the viewer to know the intricacies of how the artwork is built.

All these characteristics approximate the argument developed throughout this thesis, emphasizing the aspect of communication between the expert and the public, a way to distribute knowledge.



Fig. 3 – Carlo Bernardini. Submerged Breath, 2013 (vision of dusk). Fiber-optic installation, H 4 x 37 x 28 m. Metz, Moselle Canalisée, Square Du Luxembourg, Moyon Pont. Source: Courtesy of Carlo Bernardini.

Methodology

The main question, objectives, and focus

The study begins with a more general question, which gradually develops into a more specific question, main question: *How can design meet light art to improve the use and the aesthetic quality of urban environments, with greater inclusion of ordinary people in the design process?*

The overall objective of the study is to stimulate the generation of urban environments and urban furniture that are thought-provoking and suitable for daily living in the contemporary city, in an inclusive way, with the authentic participation of the ordinary people in the design process.

The specific objectives are the following:

1. Strengthening the participation of ordinary people in the conceptual phase of the design process. That is, by inserting their participation in crucial, decisive moments, and not only in the moments of fruition of the results defined by other agents;
2. Looking for references in the broad and rich repertoire of contemporary art, and particularly in Light Art, to create intriguing and instigating environments that could stimulate a differentiated, active and interactive experience with urban space;
3. Seeking references in initiatives that act on micropolitical scale for the creation of environments connected with the daily micro-reality of users, as is the case of several examples found in the scope of Tactical Urbanism and Design for Social Innovation;
4. Giving potential to the intermediate urban space (IUS) as a possible place for dialogue between experts and ordinary people.

To approach the authentic participation suggested by Sousa (2006), it is necessary to address the efforts to that stage of the design process that is believed to be the most important one in defining the final outcome of the intervention, the conception phase of the design process.

By the conception phase of the design process this study refers to the creative stages usually occurring at the beginning of the design process and which can decisively influence the final result, be it a product, service or urban intervention. Obviously, it is not a very simple task to accurately identify such a phase, since the design process is complex and has many inputs with significant influence over the final result.

Methodological approach

The methods and tools used in this study

The methodology of this study contributes to the discussion through case studies, interviews, and a workshop. Different tools were utilized such as surveys, semi-structured interviews, informal conversations, direct observation and more. Because of the space constraint, I will give more emphasis in this chapter to the analysis of the case studies.

Case studies

The case studies are related to the relationship between light and participation in a number of contemporary art experiences. Three case studies were considered in the methodological approach of the thesis: *Metis Lighting lives in via Padova* (Metis Lighting + Padova Street is better than Milan), *Borderlight* (Borderlight/NonRiservato) and *Green Light Workshop* (Studio Olafur Eliasson + TBA21). There are also collateral case studies involving participation experiences in instances of tactical urbanism and design for social innovation, aiming to gather data about the strengths and weaknesses of both.

Interviews

The criterion for the interviews was choosing light artists, whose work evoked a strong visual fascination and offered the possibility of raising questions about potential forms of participation and interaction with the public. Another relevant aspect was the availability of the material in the works (easy access, preferably to be visited personally in shows, workshops, and other events). Other informal interviews and conversations have also taken place with lighting designers, architects, and other artists working with light in urban contexts.

The table below shows the number of questions asked to each interviewee, the number of answers received and what interviews were published partially or totally, with the respective number of questions and answers of each one (tab. 1).

Tab. 1 – Light Artists Interviewees

Interviewees	Paolo Scirpa	Carlo Bernardini	Pietro Pirelli	Marco Brianza	Balint Bolygo
QUESTIONS ASKED	5	10	10	9	10
ANSWERS RECEIVED	5	10	10	9	7
QUESTIONS / ANSWERS ALREADY PUBLISHED	5	8	7	-	7

The interviews with five light artists were conceived in order to have a glimpse of the authors' willingness to include, among their inputs in the

creative process, the contribution from viewers, and not just in terms of fruition of the works.

The methodology adopted is qualitative, using semi-structured questions. The questions were varied of number (from five to ten) and of content based on the type of work created by each artist. They involved the relationship with the public space, with the users, with the concepts of time and space, the relationship with technology, and the possibilities of future development of the works.

The questionnaires were carried out in English or Italian, based on the native or most comfortable language of the interviewees, and sent by email. The selection of the interviewees was also based on the proximity between the respective artistic works and the issues addressed in the study; particularly with regards to the change in perspective and therefore the change of atmosphere in a specific urban space (internal or external).

Workshop: Co-designing and participation in the conception phase of the design process⁴

This consisted in a co-design activity, involving 43 interior design students, three light artists and two architects, in order to propose light interventions in some intermediate urban spaces (IUS) of Milan, in order to make them attractive, exciting and usable spaces for the ordinary citizen, the user (or the frequent visitor) of the place. The activity was developed in four phases over one week, and ended with an exhibition of the nine proposals (one by group) assembled in mock-ups (fig. 4 and 5).

Students have had access to a large repertoire relating to light art, including conceptual and technological aspects, as well as contact with three artists chosen from the previous interviewees, and their respective works. The concepts relating to the type of space (IUS) to be addressed in the workshop were introduced and discussed by me and another architect.

⁴ More details about this workshop were presented in a paper at the UD17 Doctoral Forum Noisewise - Design Research in face of current challenges to knowledge, 16-17 October 2017, Porto, Portugal.



Figg. 4 and 5 – Workshop process. Phase 3: construction and assembling the proposals in mock-ups. Source: Author’s Archive, 2017.

Results

Case studies

The initiatives analysed in the case studies tend to boost more participation in the early stages of the process. However, weaknesses have been identified in the processes involving the public, as mentioned by critics who maintain that there is a “weakening of the design culture” with post-it and similar design (Manzini, 2015). Another weakness is the difficulty encountered in the continuity of participatory initiatives, in addition to the paradoxes of participation itself.⁵

The lighting design studio Metis Lighting (Italy) with the project “Metis Lighting lives in via Padova” developed beautiful and moving works in a symbolically peripheral area of Milan (Zone 2, via Padova).⁶ This initiative involved several local agents, bystanders, and children from a neighborhood school. Relating to the participation, one of the editions was more effective than others, but the effect of the whole project in the context contains a certain poetry, even if temporary.

⁵ Anna Seravalli (personal communication, Milan, 20 June 2017).

⁶ For further information: <http://www.metislighting.it/metis/urban-outdoor/jellyfish-invasion> and <http://www.metislighting.it/metis/urban-outdoor/il-giardino-che-non-ce>

For example, in the project *Jellyfish Invasion* (Metis Lighting, Milan, 2011), the creation of the intervention was properly done by a team within the Metis Lighting studio. Thus, the participation of users in their creative process takes place only to a certain degree, even closer to fruition. However, from the beginning, there was an involvement of the local association “Via Padova is better than Milan” in the process of viabilization and realization of the imagined installation.

In several *Borderlight* initiatives (*Borderlight/NonRiservato*, Italy) we see a clear desire to involve ordinary people from the neighborhoods in at least some point of the creative phase. An example would be the collaboration of citizens in the mapping of the peripheral places to be “enlightened” with the intervention, sometimes based on a light module previously defined within the scope of the collective. This module installed with the participation of people in a workshop created in the neighborhood, is subject to a potential margin of change, which in the end causes it to assume different configurations, evolving the initial module. This also includes the possibility of bringing non-specialized people closer to different values and possibilities of light, doing something that may lead some poetry to the forgotten contexts of the city.⁷

The *Green Light Workshop*, carried out since 2016 in different cities and contexts by artist Olafur Eliasson together with Thyssen-Bornemisza Art Contemporary (TBA21), goes in a similar direction, relating to the participation of ordinary people in the design process. It is based on the assembly of lamps by a network of people including refugees, asylum seekers, and members of the public, oriented by teachers and experts. It is not just about the construction of lamps, but a participatory project that aims to include these people in a wide way, engaging them, integrating them, teaching them European culture and languages, through a multifaceted program of shared learning (Francesca von Habsburg, in Zyman and Ebersberger, 2017, p. 8).⁸

During the workshop, participants have the opportunity to go through various stages of the assembly process from dyeing, drying, gluing, and fixing components to the completion of each module. Finally, they arrive at several volumetric solutions, whether or not they join other modules.

⁷ For further information, consult the collective site (www.borderlight.space/) and an interview with the group: <http://cerchiomagazine.altervista.org/scolpire-la-notte-at-traverso-la-luce-intervista-al-collettivo-borderlight-di-stefano-serusi/>.

⁸ For further information: olafureliasson.net and greenlightworkshop.org.

But how does one proceed from the assembly of a light module to social change? The journey might seem long and convoluted, yet a simple but crucial first step is to trust the potential in the non-spectacular situation of sitting down together and doing something basic with our hands – in this case, working on a lamp that is more easily assembled by two pairs of hands than one.

(Olafur Eliasson, in Zyman and Ebersberger, 2017, p. 14)

Regarding the way the people involved in the process are inserted, as well as the scale of the interventions, it is interesting to observe the proximity between the methodological approaches present in the Green Light workshop, in the interventions of the Borderlight Collective or in various experiences of Tactical Urbanism.

Workshop

The workshop identified possibilities of interaction between design and light art to improve the aesthetic experience in urban environments. It stimulated the participation of students as users and allowed them to not have to take part from the middle of the design process, but from the beginning: from its conceptual phase. The proposals enriched not only the physical dimension of the space but, more fundamentally, the symbolic dimension, transforming it into space for exchanging and favoring better experiences for users. This interaction between light art and design pointed to a kind of ordinary people's participation in the process of creating space, beyond fruition.

*Interviews*⁹

In general, the responses of the artists interviewed highlighted some intentions to promote an interaction between the public and the work of art. In some interviews, for example, expressions such as the following were mentioned:

[Pirelli] “various levels of reading” | “artistic research can (...) ‘reach’ the public” | “the work shows a touch” of magic, [if] one knows how to create awe, disorientation and even poetry” (Tibúrcio, 2018a, p. 53).¹⁰

⁹ Four among five interviews were already published (see References) and another one is forthcoming.

¹⁰ [Pirelli] “vari livelli di lettura” | “ricerca artistica può (...) ‘arrivare’ al pubblico” | “dall’opera traspare un po’ di magia, [se] si sa creare stupore, disorientamento e anche poesia”.

[Scirpa] “the so-called ‘street man’, ‘ordinary person’” | “the best spectator” | “attracted by an innovative beauty” | “participates beyond any conditioning cultural stereotype” (Tibúrcio, 2017a, p. 41).¹¹

Brianza admits that some operations in his work allow for the interaction of the public with the work, to the point of being able to modify it, but only to a certain extent. It is up to the artist to establish the control point.

Bolygo also emphasizes the importance of the interaction of the spectator with the work and adds that the experience behind the scenes of the work also counts (Tibúrcio, 2018b, p. 37).

The visions of Bernardini and Scirpa are very similar in terms of the subjective space and the use of imagination to create something beyond our habitual perception (Tibúrcio, 2017c, p. 60; Tibúrcio, 2017a, p. 40). Scirpa mentions the use of light to sculpt the architectural space, a strategy widely used by other artists of Light Art, including James Turrell. Scirpa provokes a displacement in the gaze of the spectators, taking them out of their comfort zone of seeing the same views that have always been seen and transforming them into the protagonist of a journey to “further spaces” (Tibúrcio, 2017a, p. 41).

Scirpa (like Bernardini and other artists) focused on forgotten spaces and uses his work as a way of drawing people’s attention to this type of space, causing a kind of “displacement” of the gaze, an operation also very present in several examples of contemporary art.

Discussion

Regarding the case studies, similarly to the process we can see in the *Borderlight* (*Borderlight* collective/NonRiservato) example, and again in the *Green Light Workshop* (Studio Olafur Eliasson + TBA21), the module project is developed by the studio, and not by outsiders included in the respective participatory project. However, there is participation here, too, in preparatory stages. In the case of *Borderlight* project, ordinary people collaborate in the collective mapping to choose the locations where the module should be installed, and in modifying the module before and during its in-

¹¹ [Scirpa] “il cosiddetto ‘uomo della strada’” | “il miglior fruitore” | “attratto da una bellezza innovativa” | “partecipa oltre ogni stereotipo culturale condizionante”

stallation. In the case of the Green Light Workshop, they prepare fragments of the module for the actual workshop itself.

Despite the limitations observed in the case studies, all the analysed participatory projects are therefore a first step in giving the “strangers” a sense of belonging. These initiatives are so important that they must be continually studied, understood, disseminated and improved due to their significant symbolic and social impact, in addition to the visual aspect, but without ruling out the latter as a strong and seductive element for the success of the project. Including and integrating someone from a context considered symbolically peripheral to carry out an intervention is also a revolutionary act, even on a micro-scale.

Relating to the workshop, the students that participated in it were not experts in light art, but they had the opportunity to improve their knowledge on this topic. The technological aspect and the vast repertoire of resources on light art, presented through a number of lectures at the beginning of the workshop, were strongly apparent in the students’ interventions. This was one strength of the collaboration between students and light artists. Of course, students (“future specialists” in Interior Design) do not seem to be typical examples of ordinary people but, in this case, being themselves users of the spaces in which they were invited to act as co-designers, they assumed that role.

The concept of IUS and its strong not only physical but symbolic dimension was reinforced between students and architects. The IUSs chosen by students were varied, rich and exceeded initial expectations. This may be due to choices that were real and corresponded to the students’ daily experiences. The proposals show that people alone are not enough to transform a “place” into a “space” (de Certeau, 1998). The results suggested that light can act as a bonding element, promoting the interaction between people.

The permission granted to the public to peek behind the curtain of Bolygo’s work, according to his interview, proved to be an important strategy that has also been adopted by Eliasson in several of his works (Beccaria, 2013). It is a decision of the artist that reveals itself as a kind of generosity towards the public, undoubtedly encouraging to a less static enjoyment of the work. This strategy, which is repeated in several works of light art, can be interpreted as a way of sharing knowledge with the audience that favors them, promoting a more complete experience and provoking an interaction that corresponds to a sharing of knowledge, advantageous to the action of the performer and to making a type of participation viable, to some degree.

The interviews and the workshop are, in this research, a pilot test that serves as a reference for the analysis of information and correlations with the case studies. Obviously, sample interviews and the workshop can be expanded to broaden the scope and depth of the analysis, which could characterize future research.

Conclusion

When Alejandro Aravena says that “architecture is about giving form to the places where people live” mentioning that it is not just about the “basic needs”, but also related to the strive to “integrate needs + desire”, I agree with him because I understand that “desire” must be included in the packet of “needs”, in order to achieve the sense of “intangible dimensions” defended by him.¹²

Light is considered in this study as a possibility to overcome barriers between experts and ordinary people. The potential contribution of light art in this discussion is seen from four points of view. The first concerns the ability of light art to cause displacements capable of creating perceptible changes in spaces, thus increasing aesthetic quality in a wide range of internal and external environments. The second refers to its potential to stimulate, even in very different people, common initiatives involving a certain kind of participation. The third is the democratization of access to the specific techniques and technologies used in light art. This favors a diffusion among ordinary people of other possibilities and methods of interaction towards new aesthetic characteristics, including sophisticated and refined forms that they usually do not have access to, thus increasing their ability to extrapolate beyond the limits of common sense. Finally, if associated with a particular phase of the design process – to idealize the intervention – light art could contribute to increasing the level of participation of ordinary people, promoting social inclusion and helping to mitigate a fragile point identified in the design processes, advancing the degree of participation at one of the highest levels of the scale pointed out by Souza (2006).

Regarding the contribution of this study, I would propose two new concepts: the intermediate urban space (IUS) and the conception phase of the design process. Comparing it with existing ones, the concept of intermediate urban space seeks to unite the physical and symbolic aspect into a single con-

¹² Alejandro Aravena (personal communication, Milan, 18 July 2016).

cept relative to the space of the urban experience. The concept of conception phase of the design process is addressed and seeks to understand one of the bottlenecks in participatory design processes, and proposes a step forward in the concept of participatory and interactive art. The comparison of the two created concepts with existing ones adds, respectively, something to the area of urban studies and something also to the topic of design processes.

The findings of this study are also a modest attempt to suggest contributions to fill two aspects of the gap within the emerging design culture. These two aspects are the problems of post-it design pointed out by Ezio Manzini (2016), and the difficulty of the intervention duration in time after the designers go away.

The PhD thesis to which this chapter refers to was developed at the Department of Design of the Politecnico di Milano, and financed by CAPES Foundation – Brazilian Federal Agency for Support and Evaluation of Graduate Education, Ministry of Education – MEC, through the Science without Borders programme.

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Design for Cultural and Creative Companies

Handling the Complexity of Design Support Programmes. An interpretative framework for barriers and drivers to introducing design innovation into Brazilian MSMEs

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Abstract

This chapter is based on Fonseca Braga's PhD research which looked into broadly applied design support programmes that aim at introducing design innovation into Micro, Small and Medium-sized Enterprises (MSMEs) with little or no design experience in Brazilian traditional industries. The need to better understand how elements at diverse levels support the conditions and influence the decision to use design (as along with its intensity of use) or to not use design, making empirical barriers and drivers to design innovation evident, represents the motivation behind this study. The research approach is inductive, exploratory and qualitative. Few barriers and drivers were new and distinguished from others in prior research focused only on the rationale used to address them by the interviewee or the lack of empirical evidence within design studies or regarding design support programmes. This analysis showed that barriers and drivers differ according to: (1) the context in which each project is embedded, including the economic and political priorities and orientation, as well as cultural aspects; (2) the way programmes and their projects are crafted, managed, implemented, and evaluated; (3) the background and mindset of key stakeholders who take part in these projects.

The main contributions to the design policy field are: (1) an interpretative framework at three levels to identify barriers and drivers to design innovation, contributing to underpinning strategies in order to harness drivers and overcome barriers; and (2) a design support metamodel which aims at an experimental and participatory approach to tackling design support programmes' creation, and development.

Introduction

This study¹ focuses on the Brazilian context, but the subject herein addressed can be considered of global concern, as it is a relevant issue in emerging and mature economies (see for instance Arquilla *et al.*, 2015; Raulik-Murphy, 2010; Schneider *et al.*, 2015). Micro, Small and Medium-sized Enterprises (MSMEs) are important sources of employment and contribute to decreasing the impact of economic crises (Airaksinen *et al.*, 2015; Bell, 2015; Cawood, 1997; Madeuf and Estimé, 2000; Organisation for Economic Co-operation and Development [OECD], 2016; Raulik-Murphy and Cawood, 2009). The need for innovation ranging from businesses to regions and nations has been fully recognised (Bason, 2014; ECLAC, 2015, European Commission, 2015; Galinari *et al.*, 2013; Julier, 2017; Junginger, 2014; OECD, 2014; Raulik-Murphy, 2010; Schneider *et al.*, 2015; Silveira da Rosa *et al.*, 2007). Design as a way that leads innovation and humanises technologies, keeping people at its core throughout its process, constitutes one path to promoting change at different levels: from micro (organisations, businesses) to macro (policies, territories, industries, nations, ecosystems). The designer “... is concerned with how things ought to be in order to attain goals, and to function” (Simon, 1996, p. 4), and this definition is still appropriate nowadays with the expansion of the design field.

In a world overwhelmed by bottom-up ideas, creativity, problem solving and innovation (Ito and Howe, 2016; Verganti, 2016), we have seen the emergence of social innovation, crowdfunding, open innovation and grassroots initiatives. However, we are still struggling to demonstrate the value of design from the private to the public sphere. How can design be at the core of organisations’ strategies? Is design for everyone, for every nation? This thesis contributes to taking a first step towards an answer by analysing the barriers and drivers to introducing design innovation in the context of design support programmes addressed to MSMEs with little or no design experience in Brazil. Usually, the literature, media and press focus on successful design cases.

Here, cases that can be considered ordinary were explored, admitting the fact that few firms use design strategically (Thomson and Koskinen, 2012). Our tendency to ‘follow the crowd’ and keep ourselves in the comfort zone as human beings has not been overlooked (Sternberg, 2006, 2012), as well as the fact

¹ This chapter is about the doctoral research which took place from November 2014 to October 2018 in the Design Department (Design Strategy unit) at the Politecnico di Milano. The research was supported by the Brazilian National Council for Scientific and Technological Development (CNPq).

that established organisations present a resistance to change (Deserti and Rizzo, 2014). External environment influences are also taken into consideration.

The lack of references in such contexts surrounding the factors that facilitate and that block design integration in those conditions maintain the mystery of moving up the design ladder. Our main goal is to reduce this gap through an exploratory and qualitative approach to better understand these factors and their implications on design support practices and key stakeholders.

Although there are many definitions of design and no consensus for an accurate definition that encompasses its meaning as a whole, in practice, the activities concerning design in the analysed empirical cases present an approach at project level, including:

- product and communication design,
- design process improvement by integrating ergonomic criteria into product development processes, anticipating prototyping activities,
- product adequacy to national norms and standards,
- training and workshops concerning product development and branding,
- store (point of sales) design,
- business model change, integrating a B2C model to a B2B cluster.

Innovation is understood, in the context of this study, as the transformation process of ideas into products, services, experiences, and their introduction into the market.

Other key definitions are used throughout the thesis: policy, design for policy, design policy (or policy for design), and design support.

A policy can be understood as a set of principles, purpose, and procedures related to the intentions of a government or a corporation in a specific topic (Heskett, 2001). Design for policy is defined by Bason (2014) as “a resource for government departments, public service organisations, and institutions, universities, think tanks and consultants that are increasingly engaging with design as a tool for public sector reform and innovation” (p. 3). It can be considered a design-led approach to policy development and innovation at diverse levels of the public sector (Bason, 2014).

In the argument of design for policy, Junginger (2014) stresses policy as a matter of design. The design contribution should be to provide a proactive approach rather than a reactive approach, such as problem-solving (Junginger, 2014). The author (Junginger, 2014) suggests policy-making as designing² in order to harness design potential towards desirable futures and to formulate policies according to a future-oriented approach. Policy-makers and

² Expanding on Boland and Collopy's (2004) idea of 'managing as designing'.

public managers should be able to use design tools and methods to develop and implement innovative policies (Junginger, 2014). There is little research into this emerging field within design studies (Kimbell, 2016).

Design policy or policy for design is generally a series of strategies and public-funded interventions on behalf of governments or other types of organisations such as non-profit private bodies. It usually aims at stimulating design demand and supply in view of competitive advantages for businesses, clusters, territories, countries, or of an improvement in quality of life.

Design capabilities development in the public sector is nowadays considered within the scope of design for policy field, being also previously found within the scope of design support programmes.

Design policies can be explicit or tacit. Explicit design policies “refer to countries where design is officially integrated into national policy (this can be innovation policy, smart specialisation strategies, other policy domains or even a dedicated design policy) while tacit design policies refer to countries with government-funded design policy mechanisms (this can be design support programmes, design promotion activities or design centres)” (Whicher *et al.*, 2015, p. 24).

In Brazil, the design support programmes are part of tacit design policies, not being officially addressed within other branches of national policies, and not pursuing a specific dedicated national policy, strategy or plan.

Design support constitutes one of the ranges of design policy’s activities. There are several definitions of design support varying according to the source (i.e. Raulik Murphy, 2010; Raulik-Murphy and Cawood, 2010; Sun, 2010; Schneider *et al.*, 2015; Whicher *et al.*, 2015). From these definitions design support can be understood as initiatives or programmes which aim at harnessing design within business. Most initiatives relate to small businesses (which usually have little or no design experience) but they can also refer to more strategic levels of intervention and large enterprises (e.g. one-to-one mentoring, support in product/service/communication design, support in finding appropriate design consultancy, financial incentives – e.g. tax credits, vouchers and export schemes).

Research contents

The dissertation has been organised into three parts. The first part focuses on the conceptual framework building, and provides rationales for the use of design, as well as for imitation in the global arena from a literature review and analyses the context of this research.

Chapter 1 discusses the value of design, attempting to clarify the motivations that lead organisations and countries to invest in design. The diverse value views that have been connected to design based on a literature review and analysis were conducted in order to clarify the issue of the design value. The need to approach this issue arose from practice. The idea is to evidence in a more ‘shareable’ and ‘visual’ way the value of design and related studies and fields since it has been very difficult to identify benefits directly related to the use of design (and to its use intensity). The value of design in its methods and experimental approach is highlighted.

Chapter 2 presents the counteracting (or supporting – depending on the context) role of copycat behaviour and the different reasons that have been motivating firms, people and countries to ‘follow the crowd’ or imitate. In some contexts, the copycat attitude works as an alternative to survive (e.g. Latin America) and a means (or prior step) to be innovative in the tech industry (e.g. China). The copying, imitation, and adaptation of original products has been carried out in different geographical areas and cultures, as well as in a variety of historical moments.

Chapter 3 points out the MSMEs’ relevance for a wealthy economy as well as briefly introducing their relation to design innovation.

Chapter 4 focuses on the development of the field of design policies, pointing out main studies and historical events that were crucial to moving towards the consolidation of the field, frameworks, and actors that have been identified and conceptualised to describe and visualise contexts of design policies. Research which focuses on less advanced economies is emphasised. Design support programmes’ best practices are also highlighted.

Chapter 5 introduces an overview of design policies in Brazil, and the design status in Brazil, especially from a design management viewpoint. The Brazilian Design Innovation ecosystem is illustrated, applying the framework suggested by Whicher and Walters (2014), and analysed. Design support programmes in Brazil are further explored and the main mechanisms are discussed in the light of best practices.

In this first part, a global perspective on topics which can be considered universal regarding design approach and practice is provided. This outlook is convergent with Krippendorff, Maser, and Spitz’s (Bonsiepe *et al.*, 2015) thoughts on the universal character of design. Krippendorff (Bonsiepe *et al.*, 2015, p. 18) claims that “...design is a basic human ability to construct or improve on the construction of our world with responsibility to those affected, directly or indirectly”, and although “... there are cultural differences to be honoured... the process of proposing responsible innovations is not explained by national boundaries”. Maser (Bonsiepe *et al.*, 2015, p. 18) em-

phases that “any distinction should rather be project-specific and task-focused” relating to the field of application, not to national labels. Spitz (Ibid.) also addresses design as an “international phenomenon” being historically “a substantial part of industrialization”; in addition, she confirms her position stating that “any national label would reduce design to its superficial aspects, to the style features of formal aesthetics”.

Moreover, studies on design policy (Er, 1997; Raulik-Murphy, 2010) have stressed the common role of design as a competitive tool in industries and firms (Er, 1997), and the similarity in the pattern of design programmes (Raulik-Murphy, 2010) in advanced and less advanced economies.

Thus, in this study, design is considered a worldwide practice that can be embedded in diverse contexts, presenting certain common routines, ways of thinking and acting, and expectations regarding change and future. On the other hand, the specific context of emerging countries can influence design and its use. Hence, the particularities of Latin America and Brazil are pointed out, as well as studies that have addressed design in these contexts.

The second part of the thesis concerns the analysis of empirical cases from which the overall literature review was selected in order to provide a better understanding, even though one part of this literature is previously presented in the thesis outline. All cases studied correspond to the most common models of design support initiatives applied across Brazil.

Chapter 6 explores a group of design support cases joined by the researcher. These cases are described and analysed looking at the micro level (enterprises’ level), concerning mainly what goes on within MSMEs in order to contribute to or block the use of design throughout design support projects and their implementation. ‘The choice of design: from business conditions to business attitudes’ focuses on empirical cases in the furniture industry, emphasising the role of firms’ conditions and attitudes during the integration of design into their (not design-oriented) small businesses. This issue emerged from the researcher’s first-hand experience and was one of the gaps mentioned in chapter 1 with regards to the value of design, concerning the capacity to ‘absorb’ design. Most design policies focused on the integration of design into micro, small and medium-sized enterprises (MSMEs) and studies on design management ignore differences relating to the decision by key stakeholders to deploy creativity and its implications including, for example, the lack of sufficient value to move on to the next level of the design ladder, and the mindset and experience regarding design knowledge and practice.

Although the topic of design attitude was previously explored in Michlewski’s (2008) exploratory study, the attitude in a small business with little or no design experience that contributes to or undermines the use of

design has not been empirically looked into. This chapter addresses the use of creativity resources as a decision at the micro level (enterprises' level) using insights from Sternberg and Lubart's theory of investment (Sternberg, 2006; 2012) in the psychology field, in order to better understand empirical evidence of success and failure in absorbing design management capabilities – from Acklin's (2011; 2013) proposed framework – through design policy projects of integration of design into MSMEs or design support programmes. The main methods used in this first research phase were the author's participatory observations and the literature review. The literature review included topics which were selected considering the potential to contribute to the comprehension of empirical cases and the gaps that surpass the lack of economic resources to promote the absorption of design capabilities in MSMEs.

Chapter 7 expands this outlook with polar type cases, in which the researcher did not take part, focusing on three levels of analysis ranging from human beings (related to individuals, actors) and organisations (micro) to the ecosystem (external environment influences), broadening the analysis landscape. A framework at three levels is proposed in order to support barriers' and drivers' visualisation and analysis.

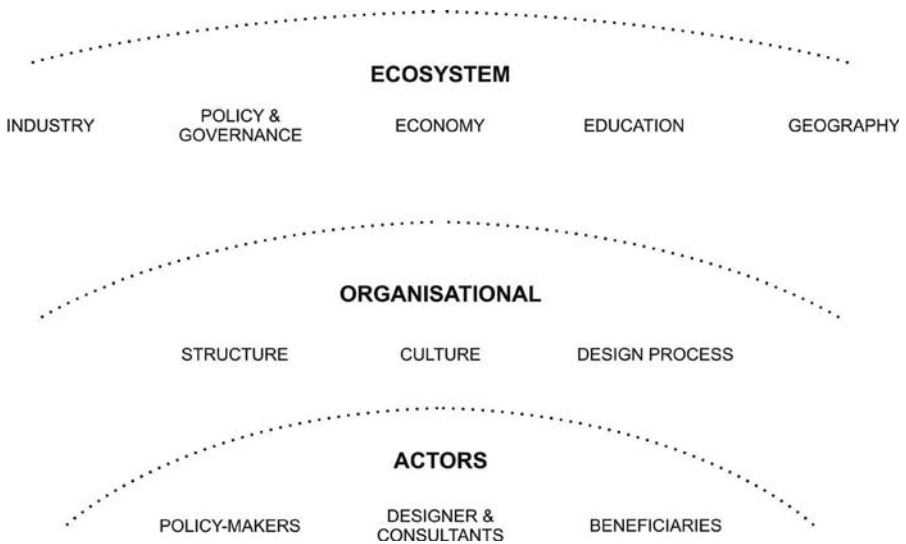


Fig. 1 – An interpretative framework for barriers and drivers to design innovation at three levels

Moreover, the limitations of the map of perceived businesses conditions and attitudes, the output of the study's first sample of cases, were also pointed out and assessed in depth. The second sample of cases also has the pur-

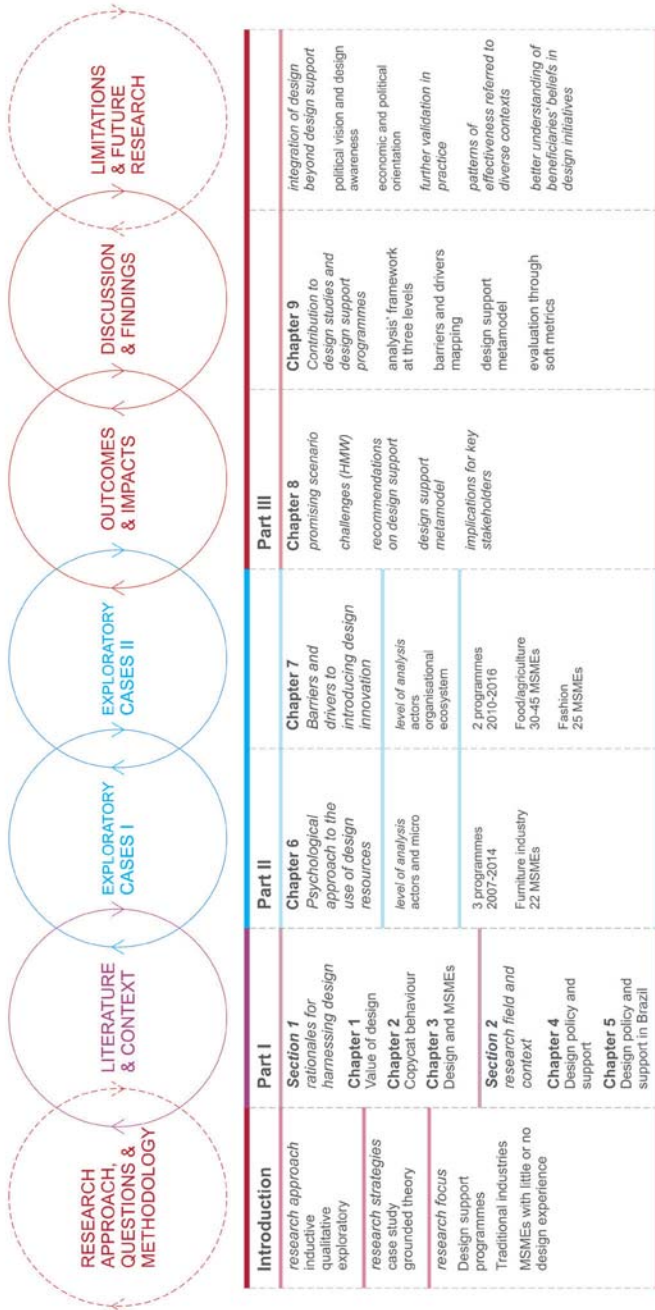


Fig. 2 – Research cycles.

pose of overcoming a number of limitations faced in the first phase of empirical case analysis, such as the lack of the key stakeholders' point of view and confrontation with other designers and consultants' experiences when implementing design support projects. Two projects in which the researcher did not take part were selected in collaboration with a non-profit private entity (that is, the main design support agency for MSMEs in Brazil) in order to provide a new input of empirical evidence for the study.

The third part of the thesis concerns the findings and reflections on the study as a whole and its outcomes.

This chapter emphasises our main findings.

Findings

This study shows that barriers and drivers at the actors' level were more frequent and easily recognised by a range of key stakeholders, likely because they benefitted from sufficient face-to-face contact throughout projects that helped them identify one another's drawbacks and strengths. The lack of background in design management of policy-makers (which is already stated in prior research), the absence of a prior company design audit led by people with a design background and the introduction of designers usually due to the implementation of a programme underpinned the fact that many barriers that are already discussed in prior research focused in the context of MSMEs might exist but were not addressed on an organisational level.

Promoting ecosystem changes requires a network of key collaborators that agree and attend to each other's needs which should be set out in order for action to be taken, sharing a purpose and strategy. Most barriers and drivers at the ecosystem level were not identified by interviewees despite the fact that they are clearly quoted in prior research addressing the Brazilian context. They were only recognised when directly affecting the established programme process or programme implementation, relating to day-to-day constraints and short-term outputs. Though they are crucial to moving towards a promising scenario, people seemed to get used to them. Hence, one might not be aware of a problem because one cannot recognise it in a long-lasting situation that takes place on a national level. Thus, the proposed framework helps raise awareness of their existence, emphasising the importance of setting up collaboration opportunities with a variety of stakeholders (e.g. governments, institutions, universities, industry, firms, designers associations, industry unions) in order to achieve consistent changes through a more systematic and long-term development strategy.

Few barriers and drivers were new and distinguished from others in prior research regarding only the rationale used to address them by the interviewee or the lack of empirical evidence within design studies or regarding design support programmes.



Fig. 3 – New, mentioned, and not mentioned barriers at each level.



Fig. 4 – New, mentioned, and not mentioned drivers at each level.

Barriers and drivers differ according to: (1) the context in which each project is embedded, including the economic and political priorities and orientation, as well as cultural aspects; (2) the way programmes and their projects were created, managed, implemented and evaluated; (3) the background and mindset of key stakeholders who take part in these projects.

A design support programme metamodel was proposed addressing the design support programmes’ drawbacks. This metamodel, as well as a three-level framework, should be seen as a dynamic metamodel that can change ac-

ording to the specific project’s context and its characteristics, the industry typology, the level of intervention (local, regional, national), and innovation needed, the background of people who use them, and time (barriers and drivers can emerge or change and can vary in a certain context, becoming more or less relevant). An expert with background in design policy or in design management, and in participatory methodologies, is suggested in order to moderate a collaborative and more participatory approach, helping lead and figure out controversies that can arise, promoting symmetry of key representatives’ participation, checking the awareness of possible barriers and drivers that can be overlooked, as well as solving issues regarding design concepts and contents and their relationships with a broader context (or ecosystem).

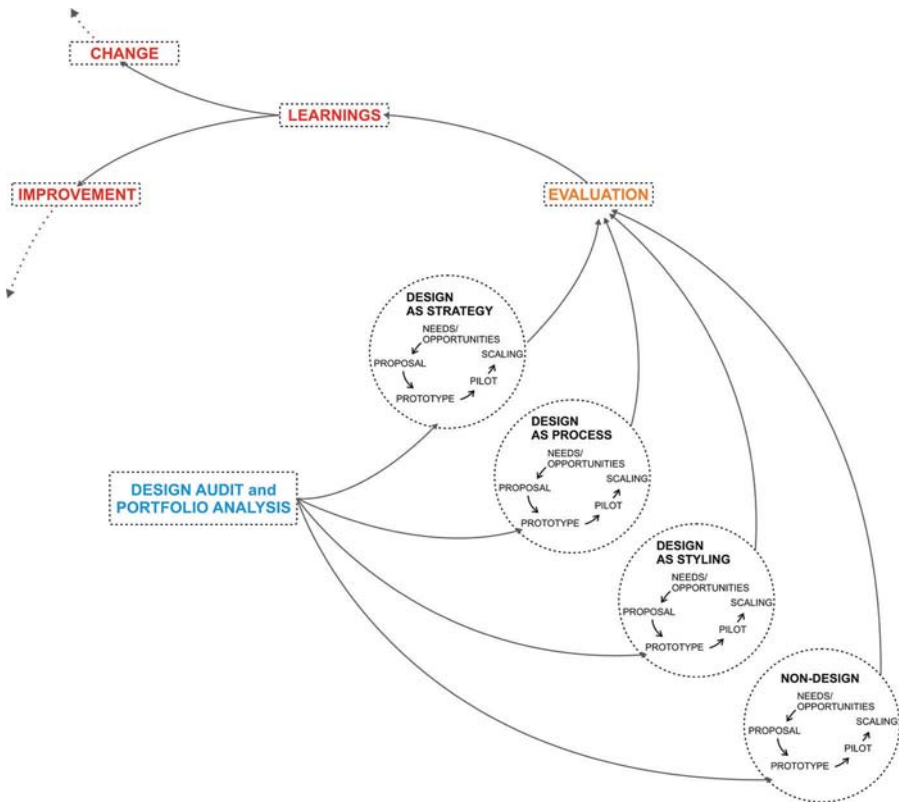


Fig. 5 – Design support programmes’ metamodel.

A promising scenario was envisioned through the selection of critical variables which were organised within 5 headlines that are emphasised in prior research, particularly research which focuses on less advanced econo-

mies, and some of them were reinforced by empirical evidence which arose from the analysis of interviewees' speeches. They were:

- the design support programmes/projects have an important social and economic impact;
- the processes of policy-making are participatory;
- the programmes/projects are evaluated and monitored with regards to short- and long-term benefits;
- the organisations are international market-focused, human-centred and future-oriented;
- the actors are design-aware and build on appropriate education and skills to lead design innovation.

If you have any questions regarding this study, please get in touch with the authors and have a look at this PhD dissertation to explore further details.

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FashionTech: Interaction Across Boundaries. Integration practices for design-enhanced user experiences

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Abstract

The purpose of this dissertation is to identify the tools that are necessary to streamline the design process of fashion products with embedded technology.

This study endeavours first and foremost to summarise and provide a critical analysis of the state of the art in fashion innovation by referring to both the relevant contemporary literature and market analysis documentation. It especially focuses on FashionTech, a sector which derives from the interaction between fashion and digital technology, and it explores the role played by new technologies in creating interactive experiences for consumers.

This work's theoretical research stresses the great opportunities made available by new digital technologies embedded in products, especially as far as interaction and the generation of consumer experiences are concerned, as well as the widespread interest that pervades markets; on the other hand, it also emphasises their limitations and the open challenges deriving from methodological deficiencies.

By using the identified limitations as a premise, the study then introduces a number of methodological tests on the designing of fashion products with embedded technology, which have been carried out both in academic circles and on the market.

The outcome of these tests is presented as a methodological proposal and as a tool for integration-based design. This approach allows the study to highlight the need to train professionals capable of playing a cross-cutting role in the integration process between the disciplines and the actors involved.

A Border Line Condition

Modern Wearable Technologies

Although enormous progress has been made in this sector and the boundary between fashion and technology is increasingly less defined, the FashionTech sector, and especially the wearable technologies subset, is facing an important challenge in social, cultural, linguistic and methodological terms.

One of the roles which fashion has always played is the transformation of technological progress such as smart fabrics or new materials into products which are wearable and appealing to consumers; indeed, fashion and accessories were among the first vectors to bring technology into contact with the body's physical dimension (Fortunati *et al.*, 2003), and nowadays they are essentially a physical and aesthetic extension of the body itself.

The fashion system is now fully permeated by technological advancement, products with embedded technology or, in more general terms, by FashionTech and its forward-looking vitality.

'Wearables are one of the newest frontiers in the tech space', 'wearable technology like the Fitbit is becoming increasingly popular and that trend is only going to increase as the technology improves' (Hastreiter, 2017), 'technological innovation, or FashionTech, is a strategic issue for the fashion industry's future, and the arrival of technology in this universe continues to shake up codes and practices' (Premierevision.com, 2018), are only some of the statements that have been made regarding the trends shown by the wearable technology market.

While global sales of wearable products with embedded technology are on the rise, they have not yet matched expectations. In 2017 the overall percentage of sold devices, including wristbands and watches, reached 7.5% of the mobile phone market, with a 7.3% increase as opposed to the previous year. By comparison, Statista has estimated that the average smartphone sales increase between 2005 and 2015 was about 35.6%, and for many years they even reached 60% before they settled on the present, relatively stable sales trend.

It is nonetheless important to clarify that contemporary trends concerning all products of this kind are extremely unstable. Although smart bands used to be top-selling items, in 2017 their sales dropped dramatically; the analysis carried out by Matt Turk (2018) showed that Jawbone had been shut down, while Fitbit and GoPro's share price has noticeably fallen since 2015 and 2016.

Some doubts also persist in other related sectors: the Consumer Electronic Show 2018 (CES) did not show any increase with regards to the sale of wear-

able technology on the mass market. As for watches, market demand is mainly met by the electronics industry, but even the soundest companies (i.e. Samsung, LG, Huawei, etc.) are seemingly following traditional production patterns.

Market analysis has moreover shown that business models based on the B2C sale of fashion products with embedded technology often struggle to be sustainable. Between 2017 and 2018 start-up companies active within the sector such as SolePower, Vinaya, Ringy and Wisewear announced their withdrawal from the market (Fashnerd.com, 2018).

Market Limitations and Design Opportunities

‘Unstable’, ‘energy-consuming’ and ‘erratic’ are some of the definitions provided by many fashion company executives when asked to describe succinctly the sector in which they operate (The State of Fashion, 2017). Their perception is reflected in the sales data for 2017, which for instance showed a dramatic drop for many smart band producers. Unlike sales of devices such as smartphones, the slow growth of the global sales of fashion products with embedded technology poses limitations on more than one level.

The present analysis seems to indicate that the limitations associated with fashion-related technology products aimed at the consumer market are mainly caused by the business models adopted by fashion companies, which struggle to manage the various process stages.

With the rare exception of Fitbit, Fossil and Apple Watch, FashionTech products presently on the market have not recorded satisfactory sales levels. The UXS Technology Planning Report: Wearables compiled by Strategy Analytics’ User Experience Strategies (UXS) department explored consumer needs, behaviour and expectations with regards to wearable devices and remarked that hardware design is one of wearable technology’s most complex aspects, which places a rather burdensome constraint on the whole project. Indeed, wearables are required to meet specifications such as size, energy consumption, safety, interaction performance, and they are expected to be affordable, comfortable, non-invasive, and in many cases even fashionable. Greater functionality and power inevitably entails greater size.

One of these products’ main limitations is power supply, an aspect of which is for instance their battery life. The performance of wearable devices, especially jewels, is much inferior to smartphones: given their limited dimensions, they can only afford to use small-size batteries. Bigger batteries would of course be more powerful, however, they would also reduce the final products’ degree of wearability and comfort, and additional size and

shape-related constraints would then emerge to complicate their design and aesthetics. One of the main goals that is being pursued nowadays is consequently the utmost reduction of battery size while increasing efficiency and, in more general terms, finding ways to power wearable electronic devices as quickly and as easily as possible.

Other problems linked to the combination of hardware and fashion products concerns product maintenance, such as the washing of clothing, fixing in case of faults or malfunctions, and component recycling. Sustainability is presently a rather topical issue, concerning the different ageing rates of traditional fashion materials such as fabrics, as well as the disposal of the electronic parts present in these products (McCann and Bryson, 2009), which is still problematic in its management (Seymour, 2008).

Past lessons have shown that the most successful products with embedded technology are those with an intuitive, easy-to-use interface and which are aesthetically refined: mobile phones, Walkman devices and music players have all become veritable fashion items.

The main goal for wearables designers should therefore be usability and wearability; their products should be able to adapt to the body without impeding natural movements. In his book *The Design of Everyday Things* (1988) Norman listed the best principles for good design: among the top aspects was the requirement that the object be self-explanatory, which means giving consumers a good conceptual model to understand the object itself, clearly marking out the parts to be used, providing directions for use, and supplying feedback on the operation performed. Hence the need for a type of design that makes objects appear intuitive and easy to use.

Simplifying technology is no easy task, however, as the process demands that numerous and complex constraints such as size, correct functioning, technology embedding, aesthetics, functionality and wearability be kept in mind; designers must be able to design as natural an interaction between products and users as possible. Some products available on the market nowadays rely on human gestures; a case in point is Neyya, a ring that takes pictures and manages digital presentations, videos, phone calls and text messages with a simple hand movement. Another example is O2upcycle, a glove linked to a smartphone that enables wearers to answer phone calls simply by raising their hand to their ear. Gestures that repetition has made habitual and automatic in people's daily life are an important starting point for designers intending to plan out a simplified use for complex objects; the goal of this simplifying process is to ensure greater product usability for those who approach technology products for the first time. Indeed, when people are used to repeatedly performing a given action in their daily lives, they no longer perceive it as

an effort; this phenomenon has been variously labelled by researchers – one could mention Herb Simon’s ‘compiling’, the philosopher Michael Polanyi’s ‘tacit dimensions’, the psychologist TK Gibson’s ‘visual invariants’, or John Seely Brown’s ‘periphery’ (Weiser, 1991, p. 78) – and highlights the importance of a non-invasive perception of technology (Berry, 2014).

A by no means secondary goal for wearables designers is thus user value, what the relevant literature imprecisely describes as ‘user experience’; in the present discussion this expression will designate products and services as a whole that can generate user value. On the basis of Osterwalder and Pigneur’s approach, the generation of user value has been described as a company’s ability to provide their users with product and service benefits. The service revolves around supplying awareness-raising information on innovation. In this sense, a source of knowledge on products, behaviour and meanings are for instance social networks, as they actively involve users in content creation and in knowledge exchange among peers, and as such constitute a learning context within wider social interaction (Baird and Fisher, 2005). The attention which these writers devoted to users, who are also millennials, may be extended to inclusive design, as in the design process developed by Henchoz and Mirande (2014). Product and service prototyping and the analysis of product impact on user experience are of paramount importance, as they can lead to unexpected results. Redström (2006) maintained that a discrepancy between the products’ planned use and their actual employment by end-users will always be inevitable, and on more than one level; he therefore stressed the importance of designing products which make allowance for this dichotomy. Designers should, therefore, always be alert to the end users’ possible behaviour and perception with regards to the product they are designing.

The Project Within Fashiontech

The Premise

The analysis carried out with the support of some of the relevant literature (Tenuta, 2017; E4FT, 2018) indicated that the limitations of fashion products with embedded technology aimed at the consumer market are mainly the consequence of structural deficiencies within the businesses active in the sector, which appear to struggle with handling all of the project aspects in a uniform way. As was shown, these limitations do not just concern products in the strictest sense: they do not concern merely the products’ technical side, their materials or their aspect, but in fact affect the whole relevant user experience.

Market analysis and references in the literature have highlighted this sector's fragmented nature, as professionals, disciplines and diverse skills manage to combine themselves satisfactorily only with great difficulty (E4FT, 2018).

Despite widespread interest towards this emerging trend, a hybrid structured methodology capable of streamlining the process, promoting dialogue systematically and merging the various approaches together has still not been properly defined. This situation indicates a lack of dialogical harmonisation among the various sectors involved (E4FT, 2018), and has repercussions for the quality of the designed products and experiences.

FashionTech is the highest point of cross-fertilisation between fashion, industrial design and IT; aesthetics, comfort, the users' central role and usability are all applied to the electronics and digital technology sectors, the advancements in which and progress in multifunctionality, performance, size and costs are FashionTech's main driving forces. In consideration of the complexity of the approaches and of the diverse actors that are involved in it, it becomes indispensable to develop a common code that may ensure a greater degree of communication among all these sectors and, by extension, encourage synergies among the various processes.

The main goal of this part of the discussion is attempting to define a methodology that can actually reconcile fashion design processes and engineering approaches. Its achievement could bring about the training of more versatile professionals: these could potentially manage the growing research on wearable technologies, in view of developing new skills and designing innovative products that can enhance user experience, perform better, and be more aesthetically appealing.

This research will therefore now turn to the streamlining of the design process especially in the context of academic training, with the ultimate goal of subsequently applying the outcome to non-academic practice.

Towards a Hybrid Process of Product Design

At this stage in the present discussion it is perhaps advisable to list those contributions which have been instrumental in the development of this research's practical part.

Worthy of special mention is the study carried out by Tenuta (2017), as it demonstrated that traditional fashion design methodology is ill-suited for the production of products with embedded technology. Fashion's design methodology generally envisages an initial briefing stage to define the task, investigate user needs and desires across the sectors, ascertain which products and

competitors are already on the market, as well as to identify trends, materials and the most suitable innovation techniques. A concept is then developed through a brainstorming session to evaluate and select the best solutions that can fulfil parameters determined in advance, namely the product's ergonomics, aesthetics, functionality, performance, materials and costs. Sketches and technical drawings follow suit in order to develop preliminary prototypes which will pave the way for the actual products. Whenever both fashion design methodology, like the one described above, and engineering approaches are employed in the design of fashion products with embedded technology, they are either applied separately and alternately, or else in an imbalanced ratio (Tenuta, 2017). A comparison between the two shows that the main differences concern their initial stages: engineering's starting point is careful, scientifically-approached market research based on wholly technical specifications, whereas the preliminary stage in the design of fashion products focuses on the analysis of trends and user needs. Indeed, while fashion design needs to identify a suitable target, the same requirement does not apply to technology product engineering.

Another important difference between the two processes lies in the final stages of product validation: fashion design methodology envisages a step for the removal of any flaws from the designing canvasses before proceeding with the physical creation of the product, whereas the engineering process entails a step for technical and functional assessments by means of quantitative tests.

Tenuta's tests (2017) have been particularly useful in the definition of a methodology, as they emphasised the importance of correctly identifying the context of a product within the design process. It is a practice that has been borrowed from interaction design, and it consists in delineating a detailed description of the specific context in which products will be used; it goes well beyond the portrayal of user needs and includes characters, behaviours, gestures, and environments. It is one of the most creative stages of the design process: the graphic representation tool known as storyboard illustrates in chronologically-ordered sequence drawings the most important moments within the context of use, and potentially lists the shapes, materials and technologies which will eventually be included in the project concept.

The Design Experience

Hands-on experience belongs to the field of applied research, and in the present instance it has been carried out on the basis of a number of design activities within the FashionTech sector. The ultimate goal was the inves-

tigation and comparison of various design methodologies by means of an analysis of the degree of innovation present in the ensuing final products; the outcome would then make drawing conclusions on their relevant processes possible. The first test was based on a technology-driven approach, the second was design-driven, while the third relied on a mixed approach.

The evaluation parameters adopted to measure the resulting products were drawn from the qualitative model first proposed by Mancini (2017): he favoured a phenomenological approach (Bertola and Manzini, 2006) to the definition and the evaluation of design innovation based on the observation and the analysis of the elements, labelled ‘Grip factors’, which enabled a number of specific products to survive market and social changes. An inclusive and humanistic model, it takes into consideration the complexity of the contemporary scenario as a whole: innovation is seen as the connecting node between creativity, planning, design, synthesis, creation, intuition, and novelty. These terms play a fundamental role in every innovative design project: innovation is only the final outcome of diverse actions performed in a different order. Unlike creation, the concept of innovation is always associated with the introduction of improvement, and can be applied in actual practice (Schumpeter, [2013]). Moreover, as Luciano (2010) observed, innovation is fickle and relative, as it is deeply tied to the context in which it occurs; it follows that these characteristics greatly complicate the assessment of each process parameter. The Grip Factor Evaluation (Mancini, 2017) is a tool that was developed to illustrate graphically the level of strength or weakness linked to each of the factors listed below by assigning them a score. It can be applied to all of the stages in the innovation process: to benchmark analyses in order to compare product characteristics, to the preliminary research stage to identify weak aspects on which to concentrate innovation, and to the evaluation stage to establish the improvement needed for a newly designed product as opposed to the previous model. The Grip Factors Evaluation is of a discretionary nature and is clearly affected by the compiler’s judgement and amount of experience; indeed, Mancini claimed it is not possible to achieve an exact objective product evaluation methodology because of the level of uncertainty and risk at the core of every innovation process. Its usefulness lies mainly in the possibility to make evaluations that are more structured and systematic, as it provides a reminder of the factors that can positively affect product dissemination and reception thanks to its multidimensional approach to innovation. Mancini has also stressed the need to set up a pecking order for each Grip Factor depending on the product sector under

examination¹. Mancini's parameters have been adapted to the needs of the sector under examination; exceeding importance has not been attached to the 'Ease in finding' factor, however, as the present case did not deal with commercialised products. Each parameter was awarded a maximum of 5 points.

¹ The Grip Factors Evaluation is composed of the following:

1. Interpretation (1A. Clearness of Meaning: it concerns product meaning, content, message, value and affordability; 1B. Specific Answer: The degree to which products provide a specific solution to a specific need (Munari, 1981); 1C. Satisfy the Needs: Since all products meet one or more needs, grip increases if a given product meets needs closer to the bottom in the hierarchy of needs developed by Maslow)
2. Formal Values (2A. Completeness: the balance between shape and function; 2B. Beauty: elegance and formal refinement are often successful parameters that can positively increase Grip)
3. Technology (3A. Material Optimisation: the ability to make the most of the possibilities provided by materials. It also has positive repercussions on sustainability and affordance 3B. Complementary Materials: the creative use of a mix of materials according to need)
- 3C. Availability of the Technology: the degree of availability of the technology employed to produce objects)
4. Ergonomics (4A. How to Handle the Product: the degree of ease and comfort in using the products; 4B. Safety: the degree to which products avert postural complaints, or even remedy issues linked to body movements)
5. Plus (5A. Change in the Behaviour: the way in which products influence user behaviour; 5B. Necessity Gradient: it designates the fashionable trend towards a point of no return, after which they become indispensable for users; 5C. Second life: Grip also increases when the objects' second life has been thought out and planned, as is the case with their storage when not in use)
6. Sustainability (6A. Prediction of the Consequences: Grip increases if products are sustainable in their use, shape, materials, life cycle, and recycling provisions; 6B. Moral Value: objects that do not exhaust too many natural resources, do not harm future generations, and encourage their users to adopt an environmentally-aware behaviour have more chances to last on the market)
7. Scenario (7A. Communication Skills: the degree to which products support and promote communication, interaction and sharing. ICT technology has been greatly boosted thanks to its ability to influence users in this sense; 7B. Multicultural Appeal: achieved when products can be appreciated by more than one culture; 7C. Ease in Finding: Grip increases if the objects can be found and purchased easily; 7D. Multi-Generational Benefit: the degree to which products may be used by more generations)
- 7E. Auto-Innovation: the degree to which standardised norms are met.

Case Study: Technology-Driven Processes. Smart Bag Project | Politecnico di Milano

Goal. The purpose of the pilot project was the exploration of designing and prototyping procedures within the FashionTech sector, with a special focus on a case study of smart accessories commissioned by a renowned international sportswear company. Part of the same goal also concerned the success evaluation of a tech-driven approach as regards the relevant products' degree of innovation.

Project Brief. The brief envisaged the re-designing and the prototyping of a smart backpack that could afford users a multisensory experience thanks to embedded technology. The project was therefore developed by using an extant product supplied by the brand as starting point. The actors involved were asked to employ virtual and physical prototyping methods and technologies, in order to turn said backpack into an interactive object that could encourage users to explore new possible uses.

Location and Project Timing. The workshop lasted five days, and was carried out on the premises of Polifactory, an interdepartmental research laboratory housed by the Politecnico di Milano University that investigates the relationship between design and new digital production processes, and promotes a new creative culture. The chosen location was strategically suited to the purpose: it is a research hub devoted to experimentations on advanced manufacturing, whose areas of interest range from distributed production to the designing of highly interactive services.

The Actors Involved. The workshop was organised by the University Department of Mechanical Engineering in cooperation with the Design Department, and involved a motley, multidisciplinary group of actors: 20 international PhD students from the Polytechnic University of Milan, drawn from the Fashion Design, Product Design, Interior Design, Design Engineering, Mechanical Engineering, Electronic Engineering and Architecture sectors. These were divided into four mixed groups.

Methodology. The project envisaged a learning-by-doing part which was compounded by theoretical lessons imparted by international experts in Neuroscience, Mechanical Engineering, IT and Electronic Engineering, Sound Computing, Interaction Design and Fashion Design; these supported the whole design process, and guided the actors through all of its stages.

The Outcome. The products designed by the various groups envisaged very diverse scenarios and contexts of use which included safety, active wear, mobility needs and work wear. The groups that embedded technology and redefined product aesthetics most successfully were those that were more homogeneous in their makeup, and could best combine the designers' know-how with the engineers' hardware and software skills. Product analysis showed that Mancini's model needed to be amended with the introduction of two useful evaluation factors. Firstly, the item 'originality' designating the degree to which the project supplies an original solution for the issue at hand was added under 'interpretation'; secondly, the item 'coherence' concerning the matching degree between the objects' aesthetics and the relevant brand image was added to the parameters on aesthetics. Indeed, it has been remarked that there is the need to make the notion of beauty comply with brand aesthetics, as formally irreproachable projects can still be totally out of line with the client brand's aesthetics. The groups' various outputs brought to the fore the difficulty of meeting some of the parameters fully and coherently, especially as far as the relationship between shape and function, originality, feasibility and consistency with the brand image are concerned. The high degree of integration between fashion and technology, and the associated positive outcome in terms of feasibility and originality, generated a kind of aesthetics that did indeed reflect product functionality, but was not consistent with the company's traditional brand image. Whenever the traditional brand image was complied with and was implementable from a technical point of view, conversely, the proposed solution tended not to be very original. Finally, if the traditional brand image was complied with and the project relied on original solutions, the necessary technology was still too experimental, underdeveloped or expensive for the project to be seriously considered for industrial production. The various actors cooperated on every development stage of the process, and constantly redefined its planning, technical and aesthetic constraints in order to reach their shared goal. As this case study has demonstrated, it is not advisable to start a design process that merely adds new technology-based functions to an already existing object; the final result is a lack of consistency between shape and function.

Case Study: Design-Driven Processes. Smart Jewellery Project | Politecnico di Milano

Goal. The exploration of a design process based on a design-driven approach and applied to smart body ornaments; also an assessment of design's

contribution to innovation when a scenario previously defined by the client was adopted as starting point.

Project Brief. A startup company founded in the context of MIP (the Politecnico di Milano's School of Management) strove to design a device aimed at preventing instances of violence against women and at ensuring their safety in a mainly urban setting. Their team had already identified the technology that could support the development of this project, and required help to design the ornament's outer shell.

Project Timing. The project was carried out in over three months, with actors meeting at regular intervals.

The Actors Involved. The project team included 4 marketing experts, 1 electronic engineer and 1 fashion designer.

Methodology. Designing experience.

Process Stages.

Startup company (4 marketing experts)

- Market research and analysis
- Definition of possible project scenarios
- Identification of the project idea
- Brief launch with the electronic engineer to identify the necessary technology
- Brief launch with the designer
- Concept development and aesthetics development (shape, materials, interaction)
- Seeking funding
- Jewel and technology prototyping
- Test

The Outcome. The project was originally developed in an uneven fashion, with little harmonisation among the parties involved. The technologies were selected a priori by the team without involving the designer, and although they did make the device independent from the smartphone, they negatively affected the product by making its size too cumbersome. The team believed that making the device independent from the mobile phone would constitute a great competitive advantage over similar products already on the market, but did not consider that the hardware's excessive size would negatively af-

fect the aesthetics of a product that was to be worn on a daily basis - even though it might hopefully never be needed.

From a functional point of view there is a number of products available on the market that offer a similar service; hence the importance of creating added innovation value by means of its design and its reliance on gestures and symbolism.

Case Study: Mixed Processes. Smart Bag Design at Politecnico di Milano

Goal. Analysing a design process based on a mixed, transdisciplinary approach (Vacca and Warshavski, 2016) and applied to the development of accessories with embedded technology. The experience detailed below was an instance of participant observation in applied research.

Project Brief. Each group was asked to develop a collection of smart accessories from the design stage to communication and sales. The object under examination was in this case a bag, whose main function as object holder could offer interesting food for thought as regards the interaction between content and container. What is more, the usual size of this type of accessory would allow for greater freedom of experimentation, with none of the technical constraints deriving from hardware miniaturisation.

Project Timing. Regular stage-gate reviews were scheduled in order to monitor the development of the project.

The Actors Involved. The project involved three teams, each of which included a designer and an electronic engineer; these were not newbies, but had already taken part in similar projects at university level.

Methodology. A learning-by-doing approach. The actors were left free to manage the process autonomously, and to test its underlying dynamics of interaction.

The Outcome. The products entailed different scenarios, relied on diverse types of interaction, and in each of them the user interface was a different bag component. As far as aesthetics and technology awareness were concerned, none of the projects used a screen as interface, and in no case was technol-

ogy hidden under an outer shell; rather, the technological side was made tangible through user gestures and a dynamic interaction with the products. In all three projects the technological side and the aesthetic characteristics were combined in a relationship of mutual interdependence and functionality. This approach shows that user awareness as to the presence of technology may not necessarily be something to be avoided, and that technology need not be concealed at all costs; indeed, technology has the potential to improve product functionality or performance, and if properly planned and embedded it can even become an important element in the products' final look. The definition of appropriate scenarios and the development of personas enable dynamic, relationship-based experiences to which products are improving additions. The project participants continuously shared knowledge and processes throughout all the relevant stages, and thus developed a generative methodology (Vacca and Warshavski, 2016). Crucial in this sense were the stages centred on scenario definition and persona development, that is to say, the description of the specific end-users to whom the products were destined. Nonetheless, the groups were in fact forced to have a shared design methodology throughout the project. The engineers included in each team were not merely called upon to develop the products' technical side in the last stage of the project, but did in fact play a fundamental part in the creative process by engaging in constant dialogue with the designer and by regularly updating the project constraints. Right from the initial scenario definition and persona identification, the groups felt compelled to deal directly with potential users, and spontaneously decided to engage them by means of unstructured interviews and through the empirical observation of their behavioural interaction with the relevant products. The groups also elaborated a definition of communication and a marketing strategy. In view of the fact that their dynamic products would require the provision of user instructions, they decided to explain their functioning simply and directly in videos and on websites.

A Proposal for a Methodology for Wearable Technologies Based on a Scientific Approach and on the Creative Process

The experiments described above led to the tentative development of a hybrid methodology that combines some elements from both the fashion design and the engineering methods. The two approaches are combined together to tackle problem definition, as well as to investigate user needs and desires,

the fashion market, current trends, and those innovation technologies that are ready to be applied to industrial production. The initial definition of basic requirements is followed by the most creative part of the project, in which brainstorming leads to the generation of a specific future scenario. Products are centre stage, and become the focal interaction point between users, environment, and other objects. Equally important, nonetheless, is the correct identification and analysis of specific personas on whom to tailor the project. These steps are crucial to set the project on the right course: the procedure enables designers to identify with a specific set of users and to understand their needs and issues in order to develop the project originally. The proper management of the two stages, moreover, has positive repercussions for the subsequent definition of a precise concept; it also eliminates the widespread inclination to equip objects with too many functions, and even enhances the relationship between their shape and function. The concept stage witnesses the identification of materials, shapes and interaction dynamics by means of technical sketches; experimental prototypes are then completed, tested and evaluated. Qualitative checks, which are typical of the engineering approach, are in place, and are matched by a qualitative assessment that tests user experience by measuring the intensity of the users' emotional response to product interaction. All these steps must be necessarily managed by designers and technology experts, as only the joint application of their respective skills may lead to successful products (Tenuta and Testa, 2018).

Conclusions

The contribution of this research

A toolkit

Although there is widespread and growing interest in FashionTech, as the present study has convincingly demonstrated, the data from the market survey shows that businesses operating in this sector are still extremely disorganised and struggle to manage the various stages of the design process in a systematic fashion.

In order to achieve a satisfactory degree of harmonisation it has been necessary to review the methodology and role of the professionals involved. Awareness was raised of the fact that the whole process cannot be managed by a single professional, as it requires a variety of skills if innovation is to be generated, and it was pointed out that a code shared by all the professionals involved must be developed. In order to explain how intrinsic limitations

may be overcome, a methodological proposal has been presented which provides an alternative to fashion's traditional design process, and which is the result of a test on wearable technologies.

This data could be a useful tool not only in academia, but also for the market, as it can foster interdisciplinary knowledge, and it can link and combine fashion's and IT's design process, thereby pushing the boundary between creativity and the scientific method.

The design methodology proposed here has been recently supported in its validity by the data presented by the E4FT report (2018). Through the comparison of data obtained from interviews in research centres, universities and start-up companies, the document identified some of the most important stages of the design process in this sector, and these fully match the ones suggested here; the report, nonetheless, did not deal with the stage concerning the precise identification of personas.

This study also tested the renewed design process in various contexts, found support for its approach in real practice, and bridged, as it were, academic studies on the topic with hands-on experience in the market.

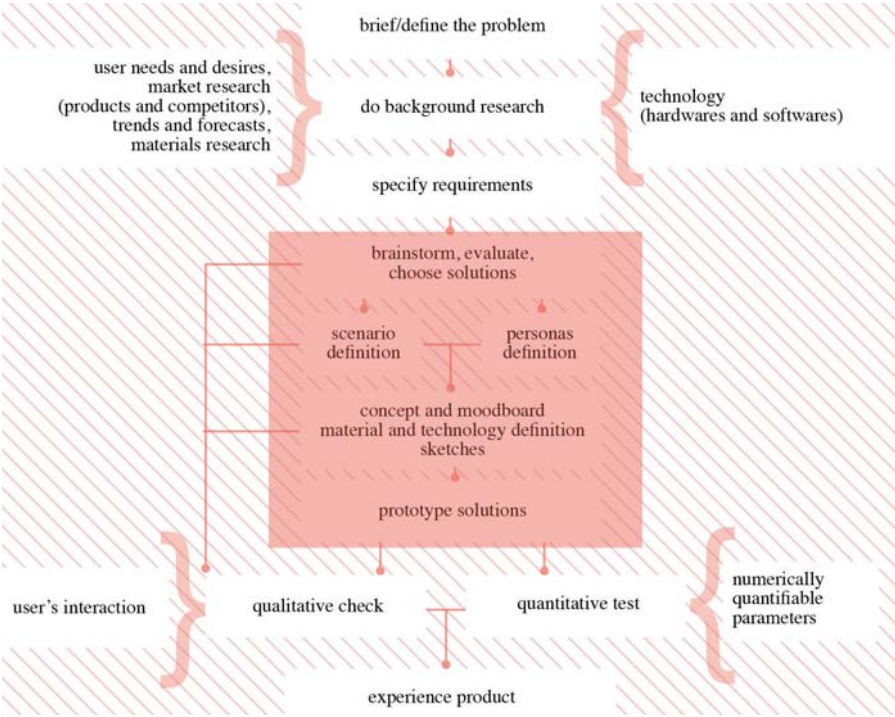


Fig. 1 – Fashion Wearable Design Method.

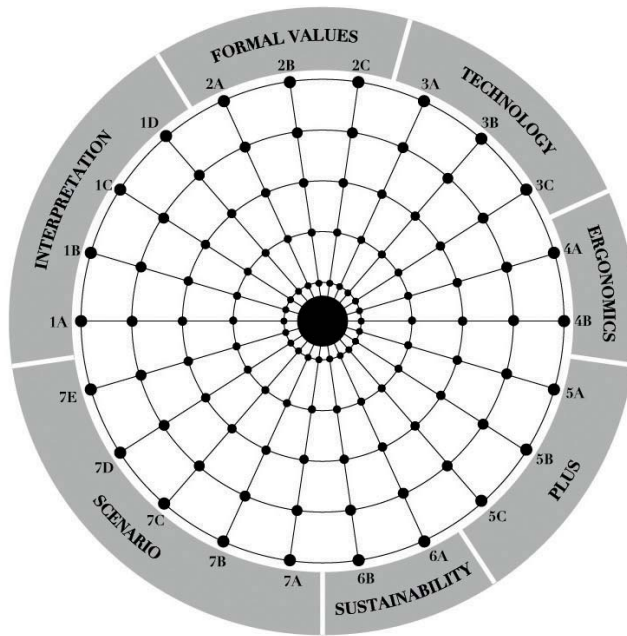


Fig. 2 – Grip Factors Evaluation for Fashion Wearables. 1. Interpretation (1A. Clearness of meaning; 1B. Specific answer; 1C. Satisfy the needs; 1D. Originality). 2. Formal Values (2A. Completeness, 2B. Beauty, 2C. Coherence). 3. Technology (3A. Material optimisation; 3B. Complementary materials; 3C. Asset of the technology). 4. Ergonomics (4A. How to handle the product; 4B. Safety). 5. Plus (5A. Change in the behaviour; 5B. Necessity gradient; 5C. Second life). 6. Sustainability (6A. Prevision of the consequences; 6B. Moral value). 7. Scenario (7A. Communication skills; 7B. Multicultural appeal; 7C. Ease in finding; 7D. Multi-generational benefit; 7E. Auto-innovation).

It therefore proposes a toolkit of sorts for those who have just started familiarising themselves with fashion products with embedded technology which provides a systemic collection of updated case studies illustrating the best and worst practices, and which especially brings to the fore those elements capable of generating an added value for consumers; in addition to this, it also offers practical tools to support the design process. It includes a proposal on design methodology, a comparison of the various approaches to the project (whether tech-driven, design-driven, or transdisciplinary/mixed), and discusses the pros and cons of each of them; it also supplies a framework – streamlined under the influence of Mancini’s proposed model (2017) – to measure and evaluate the designed products’ innovation impact on their specific sector of reference.

A clarity of purpose

The entire study stresses the importance of integration in FashionTech. In terms of products, FashionTech must combine fashion and technology, whereas, in terms of processes, it needs to bring together science and creativity, diverse forms of knowledge and codes, professionals and actors, and cross-cutting skills that range from science to design and marketing. The need to have professional experts in economics who could provide insight into market trends has also been emphasised.

To this end this work vividly discussed the importance of cross-cutting approaches to the project. Involving the various actors in contexts of shared designing, especially during their university training, would help young designers to become more flexible and more open to dialogue in a perspective of shared objectives. During their training designers could develop the foundations necessary to appreciate the technical side of the development of the technology, hardware and software needed for the project; engineers, conversely, could get the chance to become acquainted with the creative process and the basics of design. These hybrid professionals will subsequently be able to mediate between other participating experts and will guide them towards their shared project goal by ensuring that the tools necessary for knowledge transfer are supplied.

Indeed, as the great design masters have shown, designing does not mean inventing new shapes, but rather originating new behaviour.

Critical Points and Suggestions for Future Developments

It is impossible to ignore the presence of critical aspects concerning the theoretical analysis and the market survey, which mainly derived from poor access to the sources: the ones available to the present writer were numerically limited, and not all of the necessary information was easily accessible to the public. The data relating to sales volumes from the businesses active in the sector was especially scant.

Other limitations of the present work concern practical experience. The analysis presented here is mainly qualitative, and only well-defined groups of participants were engaged. Moreover, the tests carried out here have only been compared with a limited selection of market experiences, and therefore offer only a partial overview of the relevant phenomena.

Another shortcoming has to do with the non-homogeneous nature of the objects used in the tests: the design experiences were performed on a wide range of fashion items, which has not made data interpretation any easier.

As for the definition of the design methodology for wearable technology presented here, the most critical points which still await a full solution concern the relationship between shape, function and brand identity in those cases in which a project is to be developed for a company with well-defined aesthetics. Future studies may therefore examine the possibility of applying and sharing methodology in various contexts, in order to record, analyse and measure other data; special attention and analysis ought to be devoted to shape, function and brand identity, and to their mutual relationship in fashion products with embedded technology.

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Design and Technology for Social Change

A taxonomy of data visualization projects for alternative narratives

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Abstract

Data-driven alternative narratives are data activism communication practices. Non-expert and bottom-up groups of the datafied society are using open-source tools and data to provide evidence on social issues that have not been covered or made transparent by mainstream and official institutions. Data visualizations are decisive adversarial tools for the purposes of alternative narratives and thus data activism. Data designers assume the role of data intermediaries capable of transforming data into information and bringing it closer to the daily experience of individuals. This study states that data visualization for data activism must disclose their design process in order to communicate not only visual evidence but also the construction of the evidence, thus, democratizing the interpretation of data and its visual representations.

It is essential to recognize and promote practices in order to move towards a critical approach to the process of visual representation of data. Thus, raising knowledge about how data visualization for alternative narratives is occurring and how its construction process is proceeding. This chapter presents a taxonomy of data visualization for alternative narrative projects observing how data visualizations are executed to build up alternative narratives: by monitoring, reporting, investigating, archiving and cohering social movements. The aim of the taxonomy is to organize the exploration of the cases; it is not intended to over-label the organic development of alternative narratives, nor to impose a single classification. The taxonomy is proposed as a starting point for exploring the visual representation of data-driven alternative narratives.

Data activism and data driven alternative narratives

Emerging new social practices enabled by technology and data are taking a critical approach to datafication, privacy and the general use of data. These new practices use data «politically and proactively for meaning creation, coordination, participation and social change» (Gutiérrez, 2018, p. 2). One of the many ways in which data and technology are applied for social change is through the creation of narratives that subvert those delivered by dominant power structures. This study focuses on the way bottom-up groups of the datafied society are taking advantage of open-source data and tools for building up communication devices which carry alternative narratives.

Data activism is a type of activism that takes a critical approach to practices surrounding data for challenging existing power relations. «It involves a series of practices at the intersection of the social and the technological dimension of human action, with two aims: either resisting massive data collection or actively pursuing the exploitation of available data for social change» (Milan and Gutiérrez, 2015, p. 122). Data activism builds on the work of subcultures that precede it, taking main inspiration from hacker ethics and the open movement that have emphasized the use of data in activism by opening, sharing, modifying and using it to generate knowledge and seek out social change (ibid.). One of the main objectives of data activism is to remove individuals from passivity in the face of data. In this way, data activism will seek to inform how the mechanisms by which institutions of power control the data of individuals are constructed. It also seeks to share knowledge about technical and ethical practices with data, promoting training instances.

Data-driven alternative narratives are narratives based on data that shapes the facts that take place in a story not told by the dominant institutions, with the aim of making visible and evident issues for audiences to reflect over and continue to question. The use of data in this type of activism calls to action in two instances: during the process of working with data - from its extraction, collection, cleaning, analysis and shaping into visual narratives for advocacy; and after reading and understanding its visual representation, providing insights for making decisions and taking action on advocated issues. Both instances build up political statements in which designers and the related disciplines involved together decide which spectrum of reality has to be shaped and turned into communication artifacts for taking action. In this context «the visualization process is also, and directly, a tool for community building» (Manzini, 2015).

Data visualization for alternative narratives

Data visualizations for alternative narratives are adversarial tools that beyond exposing and giving visibility to issues of conflict, seek to promote a critical approach to data and its visual representation. This study raises the urgency of disclosing data visualizations so that audiences can interpret their content but also the logic behind their construction. In this way, audiences can re-interpret the data and its visual representation becoming a larger knowledgeable and critical audience of conflict representations. Thus, data visualizations are instruments for democratizing information and for the democratization of interpretation (Baack, 2015, p. 4) in which its authors and «consumers» have an ethical and moral responsibility (Tufte, 2006). Opening visualizations for its reinterpretation requires a critical design by its authors and critical reading by audiences. Both involve processes that can be guided.

The study identifies the need to raise awareness and understanding of how data visualizations in alternative narratives are occurring. A first step is to provide knowledge about how they are developed on digital platforms. As part of the research methodology, a case study analysis was conducted on 65 data visualization projects on digital platforms. This chapter presents a taxonomy of projects that use data visualizations for alternative narratives. The taxonomy is proposed as a first step for the study of alternative narratives. It offers an open method with which to observe the data visualizations involved.

Information designers as data intermediaries

Information designers have always had a relevant role in shaping and organizing information for people to decide and take effective action (DiSalvo, 2009). In today's milieu of data abundance and access, and the democratization of tools and connectivity through digital platforms, information designers assume the role of «data intermediaries» (Baack, 2015). They are capable of transforming data into information, bringing data closer to the daily experience of individuals.

Data visualizations for activism is a type of adversarial design, since they are aimed at triggering informed action. Adversarial design refers «to shapes, beliefs and courses of action with regards to political issues» (DiSalvo, 2012, p. 16), which is different from other design approaches. In other words, it is about how design can act in opposition to existing structures to make hidden agendas visible. The cases that will be reviewed through the taxonomy are built on critical narratives that use data, creating visions of

the world that represent an alternative to those provided by conventional structures of power. They are cases that define and take a position on topics of political and social conflict.

A taxonomy of data visualization projects for alternative narratives

The exploration of case studies outlines the current state of initiatives that use data visualization as evidence in projects which portray alternative narratives. It aims at gathering knowledge on current initiatives of data activism focusing on the visual elements and structures that make data actionable to advocate for different purposes. A qualitative approach was adopted in the selection of case studies, following projects: with social objectives that seek to engage audiences through the communication of alternative visions of the world; that use digital platforms and data in their communication design; that were developed by independent and mainly bottom-up organizations; that are non-profit and not business sector-oriented.

Selection criteria: spaces of confrontation

The 120 cases initially collected were filtered according to the “spaces of confrontation” criterion, selecting 65 of them. The excluded cases emerges as other ways of seeking social change through data and technology with focuses on urban and social transformations, data humanitarianism, data journalism, and digital social tools.

The criterion is structured over three main concepts borrowed from the «agonistic theory» (Mouffe, 2000) and «adversarial design» (DiSalvo, 2012) that serve as axes:

- **Dissensus** is considered a fundamental part of democracy: the starting point for creating or proposing points of view that are different from already well-established ones. It establishes a position, which is essential for debating and presenting contrasting opinions, in order to create an exchange of ideas.
- **Contestation** is a form of manifestation for challenging hegemony. It considers projects that take a contrary position on the matters represented in the visualization device. At the same time, it recognizes how challenging working with data can be due to how data is acquired and what tools are used in the process of building the visualization.

- **Revealing** directly challenges the dominant narrative by uncovering concealed facts (Tactical Technology Collective, 2013, p. 23). It makes debate, additional research and positions of influence available for future action. This axis examines those projects in which design helped people to find hidden patterns of information and aided in their reading.

The three axes work as grids for positioning the cases, observing their process of working with data (as much as it could be inferred from their available information), analysing their purposes and target audience, as well as their output through data visualization interfaces. The selected cases are «disruptive aesthetic» (Markussen, 2013) practices that re-configure the power system , opening spaces that enable alternative ways of acting.

Spaces of confrontation and “outsiders” clusters

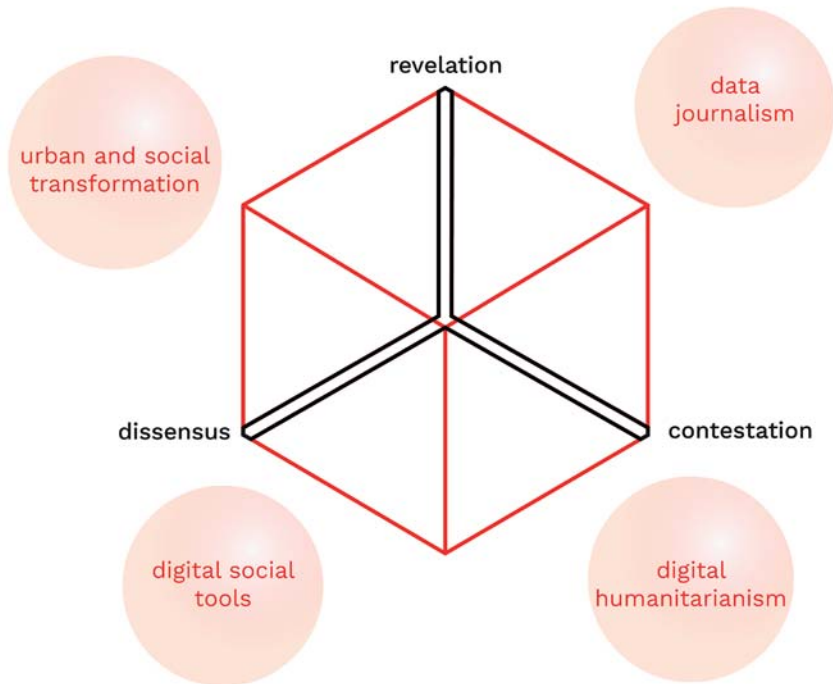
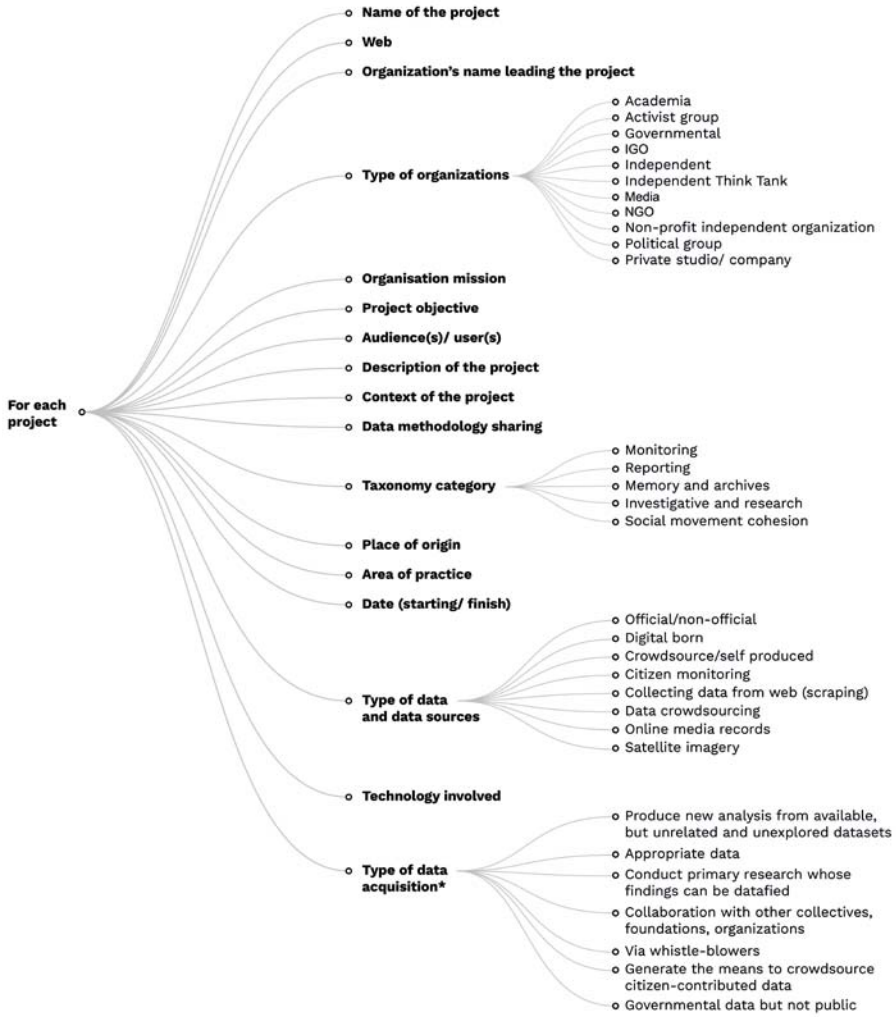


Fig. 1 – Diagram of space of confrontation (red cube) structured by the three axes: revelation, dissensus and contestation. Outsider clusters (pink spheres) are not part of the cases study. Nonetheless, they are other ways of creating alternatives for social change through different renegotiation practices with the dominant power.

The taxonomy of data visualization projects for alternative narratives

Selected cases were systematically organized according to the variables for analysis (fig. 2).



* Classification based on the work of Mirén Gutiérrez on how activist get their data (Gutiérrez, 2018, p 49).

Fig. 2 – Dendrogram diagram of variables for analysis extracted from each project.

Types of organization clustered by project topics

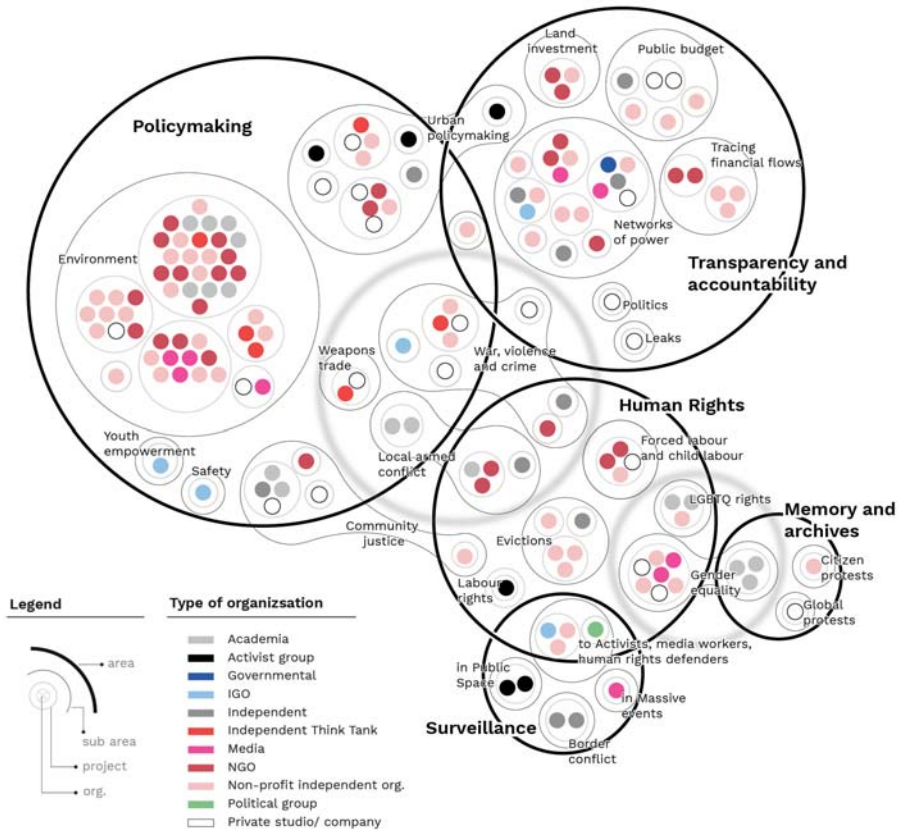


Fig. 3 – Map of the cases by area, topic, and type of organization that participates in the project, that shows how topics and areas overlap. One project can be led by more than one organization or individual. Some organizations participate in more than one project but in the same areas or topics, showing the consistency on their advocacy work.

Cases are first organized into clusters answering the question: *what does data visualization for building alternative narratives work for?* The categories were defined based on the analysis of the project objective, audience, and context. These categories are: ‘*Memory and archives*’, ‘*Investigative and research projects*’, ‘*Reports*’, ‘*Monitoring projects*’, and ‘*Social movement cohesion*’. The clusters identify the main purposes of visualization in the project they are in. The analysis of the cases allows us to identify other dimensions of the projects, such as the narrative style with which they commu-

nicate the data. The narrative styles are transversal to the identified purposes and are: ‘*Game style*’, ‘*Revealing*’, ‘*Emotional communication*’, ‘*Media remix*’, and ‘*Repurposing of existing media platforms*’. This chapter will focus only on taxonomy based on the purposes.

**Taxonomy map of data visualization projects
for alternative narratives**

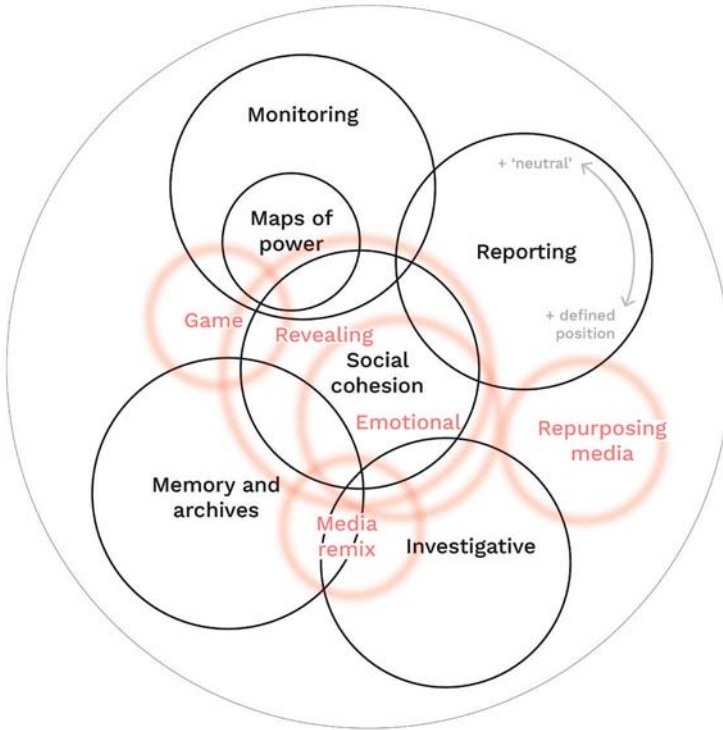


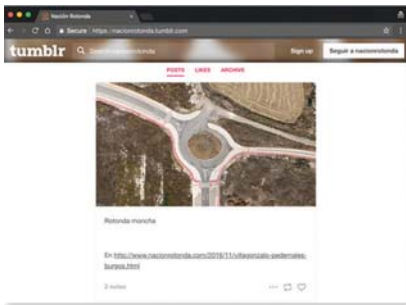
Fig. 4 – Taxonomy map diagram of the collection of data visualization cases (black circles). Narrative styles (blurry pink circles) emerge across different cases.

Memory and archives cluster

This cluster encompasses projects the main characteristic of which is to build on the memory of specific material through data collection. Archives «are not passive storehouses of old stuff, but active sites where social power is

negotiated, contested, confirmed» (Schwartz and Cook, 2012, p. 1), and thus they are power devices that create realities by storing and making pieces of evidence accessible. Archival activism is directly related to community-based archives around the world. They are «strongly rooted in grassroots activism, documenting social inequality and human rights» (McCracken, 2017).

Archival activism often serves two functions (ibid.): a) it offers access to stories, evidence, facts and arguments that can be used to advance causes and social campaigns; b) it can be considered a counterculture practices itself, archiving material that has not been recognized by the dominant official structures. The case studies in this cluster fulfil one or both functions. They embrace interactive features that allow users to explore the dataset through visualizations (on maps, networks, charts). In most cases users can download the databases and contribute to data collection (crowdsourcing data). Archives assume different features depending on the type of material collected. Material related to territorial conflicts, events, and objects respond to different requirements and thus different visual ways of representation. Archives focused on territorial conflicts usually collect georeferenced evidence that may be satellite images (fig. 5a) and georeferenced locations (fig. 5b) among others.



Project 's Tumblr archive

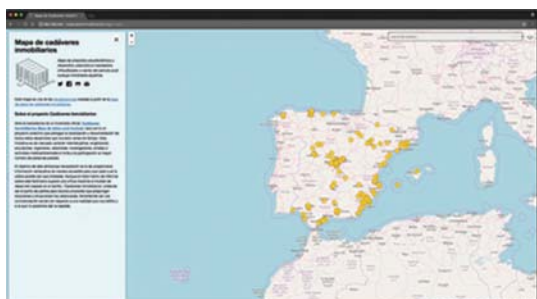


mapa de entradas (entry map)

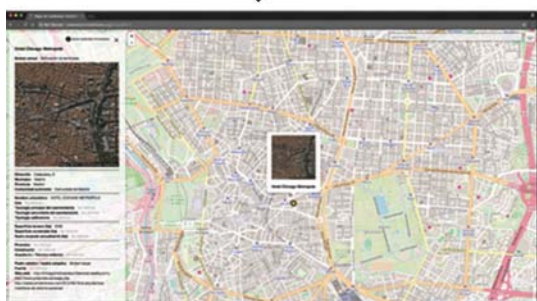


Satellite image comparison: before and after effects of the real estate bubble

Fig. 5a – ‘Nación Rotonda’ use satellite imagery for depicting the before and after effects of the real estate bubble in Spain. Screenshots retrieved from www.nacionrotonda.com in May 2018.



General navigation map (zoom out)



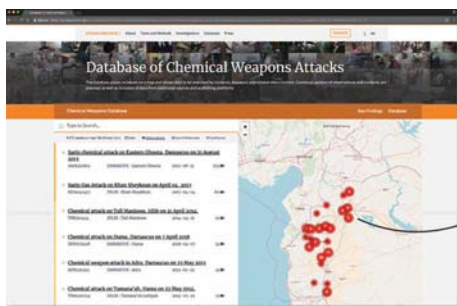
Detail exploration (zoom in)

Modular explorative maps



Fig. 5b – ‘Cadáveres Inmobiliarios’ is a mapping project of adopted vs “unearthed corpses” which collects the positions of houses of evicted families and phantom macro-urbanization. Screenshots retrieved from <http://cadaveresinmobiliarios.org> on September 2017.

Archives that document events use material that can vary widely: from the nature of the data collected (digital or digitized), their sources (official or unofficial) and type and format (images, videos, numbers, words, audio recordings, objects, etc.). Some inventive ways range from recreating virtual events (fig. 6a) to collecting the digital traces left by events as links to news articles on a map (fig. 6b).



Index of events
Database of Chemical Weapons Attack



Single event description, video and location



Video metadata, download source and direct link

Syrian Archive research methodology diagram

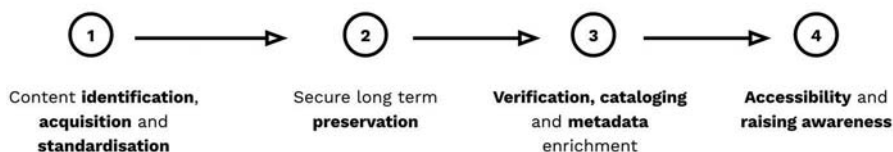


Fig. 7 – The ‘Database of Chemical Attacks’ is one of the Syrian Archive databases that archives videos from social platforms. Maps work as an index, putting in context videos, and thus attacks. Below, the project’s research methodology diagram which summarize their way of inquiring the collected material. Layout based on the description provided in the dedicated section of the platform. Screenshots retrieved from <https://syrianarchive.org> in January 2018.

Monitoring projects

In this cluster, projects seek to hold accountable and increase the transparency of the work done by top-down institutions by monitoring their actions: by constantly following, tracking, and comparing the changes. Often monitoring projects are fed by crowdsourced data. The audience is not only an observer but also a contributor of information. In this type of visualizations audiences may assume an active role in two moments: by exploring and engaging with their content; and through the process of crowdsourcing its data.

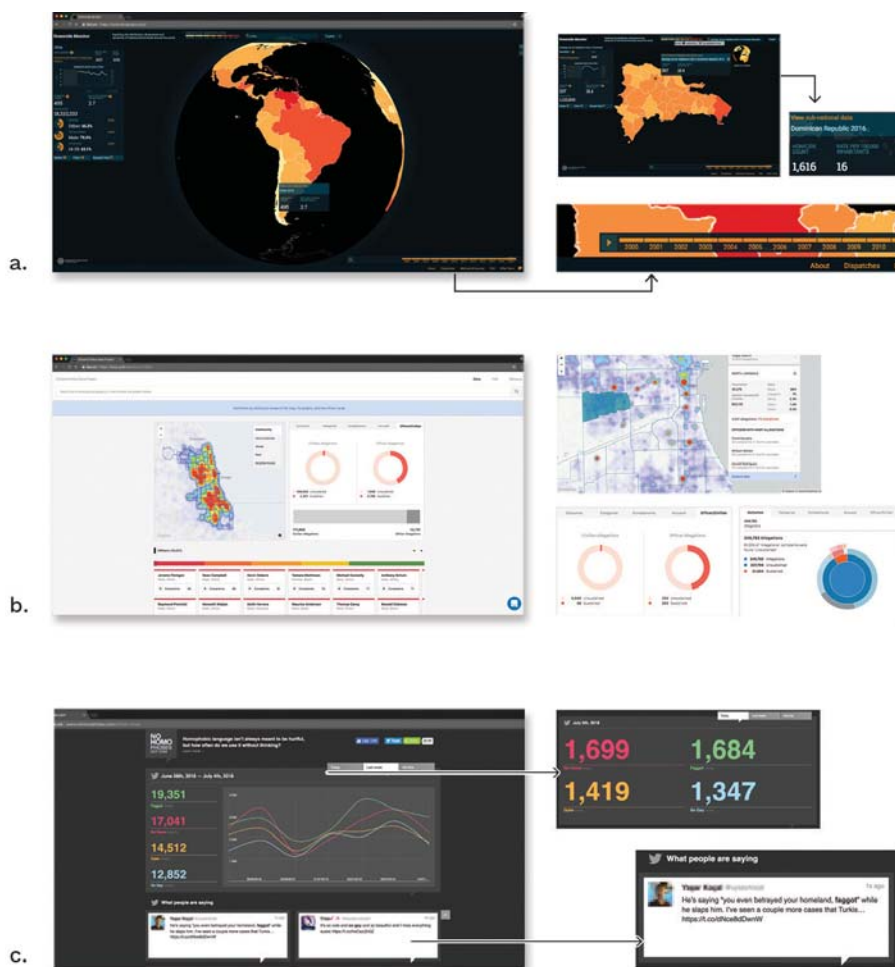


Fig. 8 – Screenshots from: a) ‘Homicide Monitor’, representations of the planet are the central element and are as important as the timelines and dashboard panel. Retrieved from <https://homicide.igarape.org.br/in> in May 2017; b) the ‘Citizens Police Data Project’ interface offers a clean clickable dashboard, allowing multiple entry points for exploration. Retrieved from <https://cpdp.co> in June 2018; c) NoHomophobesDotCom dashboard shows the number of times that hashtags are used on Twitter, aggregated by time. Retrieved from <http://www.nohomophobes.com> in June 2018.

The use of timelines to represent monitoring ranges and territorial representations to contextualize movements are recurrent. Timelines have a relevant presence, allowing users to explore the variations of an observed

phenomenon over time. Territorial representations are often used for mapping monitored flows. From representations of the Earth (either as flat world maps or a 3D globe as in fig. 8a) or zoomed-in maps (fig. 8b). Other forms of visualizations for monitoring approach dashboard interfaces that allow multiple entry points for exploration of dynamic databases over time (fig. 8c).

Maps of power is a sub-group within this cluster that monitors the influence and power relations between actors and institutions. Unlike previous cases, *maps of power* usually don't use up-to-date crowdsourced data. They monitor how power relationships operate and change in different contexts usually through network visualizations. Other inventive ways to represent these relationships can be found through the use of metaphors (fig. 9a) and customizable timelines (fig. 9b).

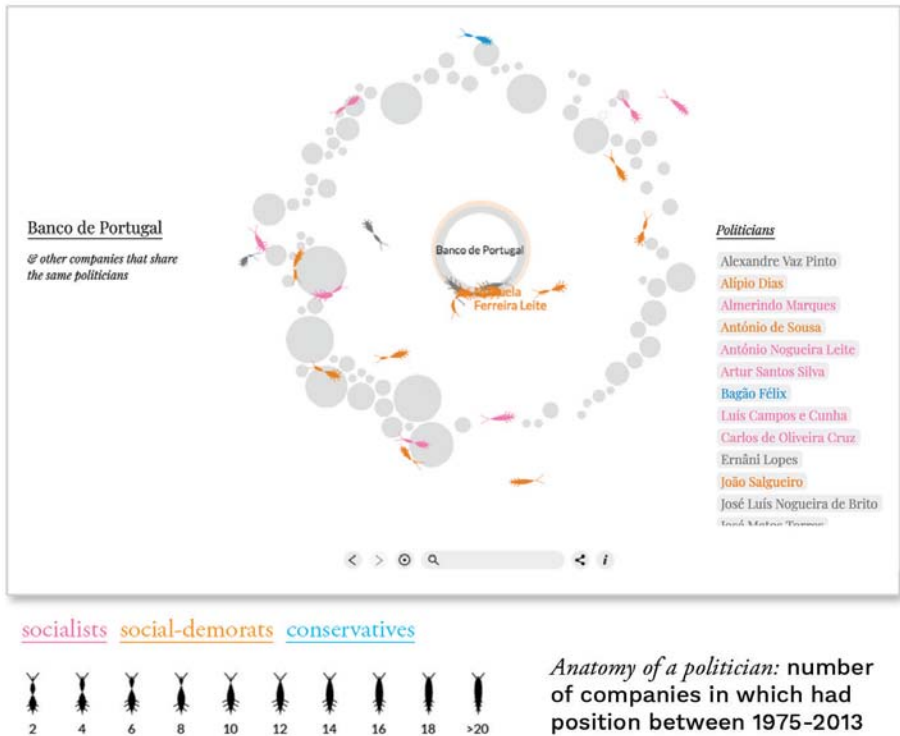


Fig. 9a – ‘An ecosystem of corporate politicians Portugal 1975-2013’ uses insects as a metaphor. Retrieved from <http://pmcruz.com/eco> in May 2018.

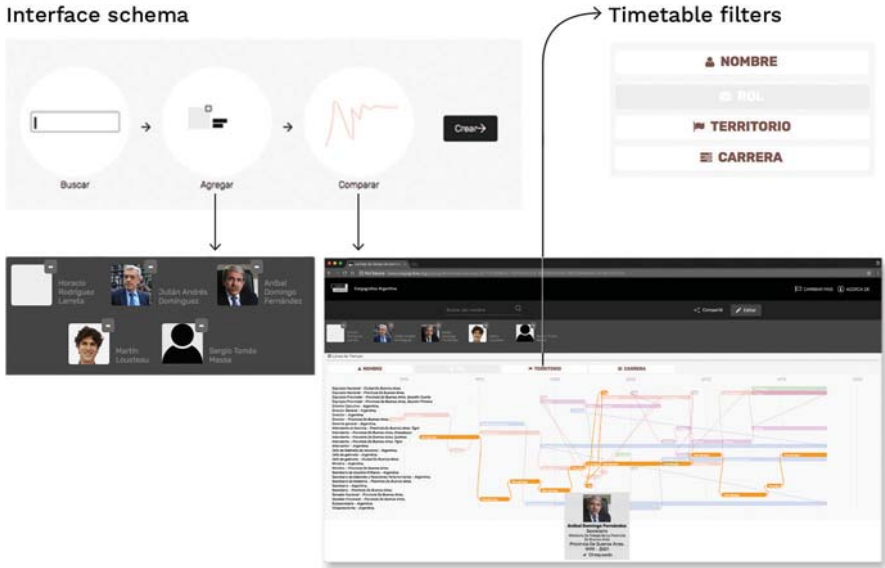


Fig. 9b – ‘Cargografias’ web interface allows users to select the actors whose relationships they wish to map, the interface creates a timeline of connections that can be filtered by “role”, “territory” and “career”. Retrieved from www.cargografias.org in May 2018.

Reports

Reports study, observe and share evidence of specific phenomena, providing an overview of something that most of the time already happened within a specific range of time, and can be verified by anyone. Their main purpose is to raise awareness and present information about the specific matter studied. Most of the collected cases that belongs to this cluster try to report a phenomenon by sharing evidence from a “neutral” position, which can be observed from their graphical resources and/or their narrative of structure: the use of labels to show the exact number represented in a chart, clear titles over visualizations, the presence of text paragraphs interwoven with visualizations, among other things. Even if no completely “neutral” position exists, these reports seek to provide facts and evidence of the phenomenon.

A wide range of report types were observed, from unemotional ones that seek to be objective without declaring a position, to reports with a stated position, which present the data as verifiable facts but offer a guide as to how they should be read. The following diagram (fig. 10) defines four areas

in which the collected cases can be divided depending on how clearly each project defines its position on the issue; or on the emotional attributes of the visual and interactive resources.

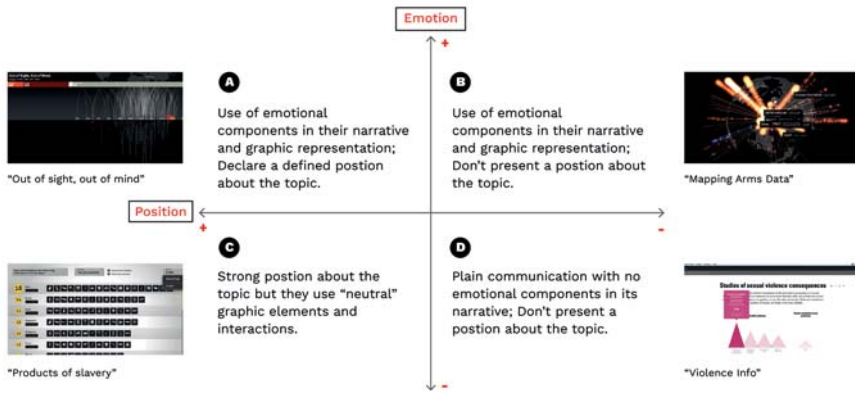


Fig. 10 – Grid of reports according on their position and use of emotion through visual and interactive resources. Diagram by the author.

Investigative and research projects

Cases in this cluster show how organisations and individuals with different skills, motivated by personal curiosity among other reasons, form groups to carry out their own research on subjects that have not been addressed by authorities or other institutions. Citizen investigations brings together different capacities (e.g. hackers, journalists, data visualization designers, academics, non-governmental organisations, artists, sociologists among others) creating new collaborations. They combine their abilities in order to collaborate in bringing to light issues that are not visible but are all around us. This cluster brings together multiple interests that may come from academia, global organisations or local counterculture groups, as well as issues that may range from local to global.

Unlike reports, investigations are usually intended to be a catalyst for further questions rather than a snapshot of the current state of affairs. This cluster corresponds to projects that delve deeper into a specific topic, gathering information from different angles and exploring different documentation techniques. It includes projects that come close to the porous boundary of data journalism. There are plenty of civic and grassroots organisations carrying out their own investigations and telling their own stories because of the

a.



b.

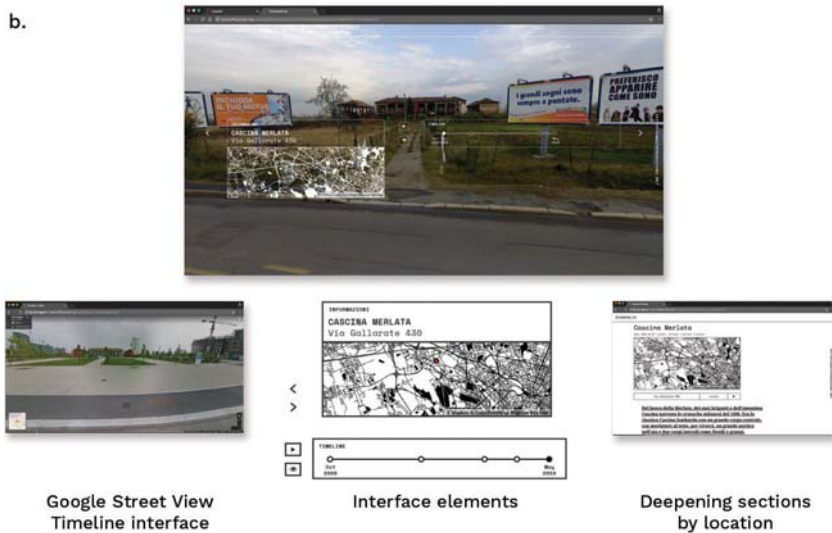


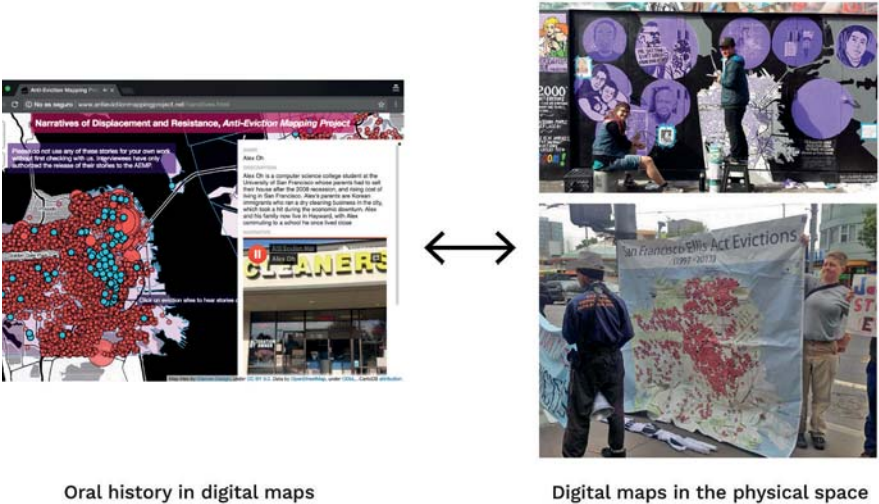
Fig. 11a and 11b – Two projects which carry out investigations using data visualization by repurposing media interfaces. a) ‘The virtual watchers’ adopt Facebook’s interface to portray their research. Retrieved from www.virtualwatchers.de on June 1st, 2018. b) ‘Scandaglio’ episode 1 adopts Google’s Street View Timeline service to dive back in time and see how speculation changed the Milan urbscape. Created by Off Topic Lab, a grassroots political lab in Milan. Screenshots retrieved from www.offtopiclab.org/scandaglio/ on May 17th, 2017.

lack of journalistic coverage of their issues (Gutiérrez, 2018, p. 43), and this may be one of the main reason that many of the investigative projects have similar characteristics to data journalism investigations.

The projects in this cluster share characteristics such as: the predominance of territorial evidence as a relevant strategy for situating the context of the investigation; the combination of different sources of data and information; use of multiple types of media to visualize different angles of the topic being investigated; and lack of crowdsourced data. Investigative and research projects mainly explore complex topics that may reference multiple layers of data and analysis, this is one of the reasons that the above-mentioned characteristics can be found in many of them. They use experimental means of visually representing their investigations. ‘*Repurposing media*’ is one of the experimental ways in which to make the role and nature of data evident as seen in ‘The Virtual Watchers’ (fig. 11a) and ‘Scandaglio’ (fig. 11b).

Social movement cohesion

Projects in this cluster seek to mobilize movements in the long term, not only for specific events or campaigns. The projects within this cluster actively combine virtual campaigns with physical activities and encounters such as protests, meetings, workshops, etc.



Oral history in digital maps

Digital maps in the physical space

Fig. 12 – The AEMP brings oral history into digital maps, which are in turn brought into the physical space of the city, participating in urban public spaces in protests and murals and other media. This project is alive in both the digital and the physical space.

The Anti Eviction Mapping Project (AEMP; fig. 12) is «a radical data-visualization, data analysis, and multimedia storytelling collective documenting the dispossession and resistance of San Francisco Bay Area residents facing gentrifying landscapes» (Anti Eviction Mapping Project, 2018, p. 289). It is an example of how information visualizations (through data visualization on maps and data stories) organize and mobilize collective action and crowdsourced practices, empowering citizens with new evidence. The visualisations and data allow users to create a space where they can dissent, reveal and contest, situating the collective as a relevant actor in the displacement and gentrification conflict.

The produced maps are created thanks to the participation of a vast number of people. They don't just represent "dots on a map" that geolocate a number on a displayed map. Instead, they are designed with built-in interactions that allow the user to explore and analyse what is in between the dots. In addition, they combine storytelling with data. The collective is careful not to reduce people merely to their evictions, instead they focus on the interpersonal stories of people involved through the collection of oral stories (ibid). The group also takes action in the physical space of the city, promoting and participating in encounters with the community involved in public spaces. In a very unique way, the project goes from people's stories to the digital space of the map, and from the digital space of data into the physical space of the city. This project is alive in both the digital and the physical space.

Disclose to tell

The exploration of case studies outlines the current state of initiatives that use data visualization in projects which portray alternative narratives. It brings knowledge on current initiatives of data activism focusing on the visual elements and structures that make data actionable to advocate for different purposes.

Transversally to the different clusters, it is observed that the visualizations are not completely open, obscuring authors' interpretations in the process of working with the data and its visual translations. It is a techno-solutionism to use visualization in data activism if its design processes are not disclosed in order to open up the possibilities of its re-interpretation. Data activism is as vulnerable to fall into technofixes as any other practice that uses technology and data (Hankey and Tuszynski, 2017). Disclosing the design process of visualizations is a way to counteract data opacity. At the same time, it turns visualizations into tools for empowering publics (Dörk *et al.*, 2013) to take

on an active role in the interpretation and subsequent re-interpretation of data and its visual representations.

The taxonomy presented is part of a larger study that proposes a theoretical framework to disclose the process of building visualizations. The disclosure of the visualizations is pertinent to authors and audiences: their design and critical reading. Based on this relationship, the *Data design framework* seek to promote a critical data literacy for the datafied society. The framework outlines four lenses that guide the questioning of data and visualizations: Open/close, Composition, Zoom and Sanitization. Each lens proposes strategies for understanding how to design and read data. The framework is an «attempt to construct alternative cultural visions as drivers of social transformation through design» (Escobar, 2017, p. 32). Many questions remain open about the possible implications of the disclosure of visualizations for alternative narratives, such as the tools and platforms with which they are constructed and displayed.

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Studying digital images in groups: the folder of images

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Abstract

Digital images, available online at an unprecedented scale, represent a valuable data source for the study of cultural phenomena. The digital nature of web images requires us to reconsider the approach to their study. I discuss four features of digital images, to make the case for the shift from the individual image to a group of images (i.e. the folder of images) as a main unit of analysis. The four features are: volume, images as data, networked nature, blurriness. As a proposal for an updated approach to visual research, I put forward the design of tailored interfaces for the study of images *in groups*.

Image research in the digital

The idea that insights into society may be acquired through the analysis of various forms of visual manifestations is common to a large number of academic disciplines. While some are specifically designed to deal with the visual (e.g. iconography and iconology), others are amended for the inclusion of images in their traditional practice, and often obtain the *visual* attribute in the process (e.g. visual sociology and visual anthropology). That images may be used for the study of society and culture is also a shared belief of various design traditions, with images profusely employed in the deluge of user-centered research methods. Referred to with terms such as, to name a few, «Image-based research» (Prosser, 1998), «Visual Methodologies» (Rose, 2016), «Visual Analysis» (Van Leeuwen and Jewitt, 2001), «Visual Research methods» (Mannay, 2015), such a widespread, yet fragmented, practice has prompted scholars to attempt describing under a unique term a

«growing disparity of visual approaches» (Pauwels, 2011). The profusion of edited volumes dedicated to «researching with visual material» (Rose, 2016) may indeed be read as the signal of a very fragmented field, or a lack thereof.

To complicate matters, the digital, in its broader sense, and more specifically the web, has profoundly changed visual culture. The renewed nature, means of production and role of images in our digital society demand a re-consideration of the methods used for their study. To think of the image found online as a new, inherently different, research object, means to productively think about the new analytical opportunities that rise from its digital nature, as well as to its challenges. Relatedly, in the call of the 11th Digital Methods Summer School (2017), dedicated to Digital Methods for Visual Research, it is asked: «does the online make a difference to the study of the visual?».

In order to make the case for the study of images *in groups*, in what follows, I discuss four features of the digital image and the implications of its use for social and cultural research: volume, images as data, networked nature and blurriness. The first refers to an unprecedented availability of visual material, and to the danger, including for visual researchers, of adhering to the «problematic underlying ethos that bigger is better, that quantity necessarily means quality» (boyd and Crawford, 2011, p. 6). The second feature introduces images as (machine-ready) data, scanned efficiently at a massive scale by proprietary «machine-to-machine seeing apparatuses» (Paglen, 2016), thus raising the question of what visual research can add in a data-intensive society. The third feature presents images online as nodes of a network (Niederer, 2018a) and calls for the inclusion of the work of users and platforms in a networked approach to visual research. The fourth point concerns a general blurriness of the digital image, that loses its uniqueness online, becomes unstable and «in motion» (Steyerl, 2009), and thus is harder to capture and study.

Lastly, I draw from the aforementioned features to call for an approach to visual research attuned to the digital nature of visual culture: an approach that considers images *in groups*, and treats them not as isolated from their (digital) context.

Volume: more images

For the project «24 Hrs In Photos», Erik Kessels (2011) fills a room «from floor to ceiling» of the Foam Gallery in Amsterdam with thousands of print-outs: every image uploaded online in one day. The exhibition lets visitors experience the feeling of drowning, quite literally, in a sea of daily produced visual content. It is a recurring endeavour to measure, or estimate, the vol-

ume of images out there. Since 2014, the Kleiner Perkins Internet Trends Report returns the daily number of shared photos on selected platforms, per year. In the lack of such data in the 2017 version of the report (Meeker, 2017), one may read a signal of the pervasiveness of images on the web, that no longer need to be counted, as they have become the main currency of any online transaction. With images being the chosen means for most online tasks – documenting, searching, trolling, sharing – photography has become «ubiquitous» (Hand, 2012), closely intertwined with our networked life.

In an «image-dominated network society» (Mirzoeff, 2015, p. 13), methods for visual research based on the close engagement with images, or «attentive stance» (Rose, 2016, p. 10), might seem unsustainable, or «unlikely to be effective» (Ibid.). The unprecedented availability of visual material, raises new methodological challenges of «scope, scale and selection» (Hand, 2016). If images are everywhere, where do we look? The data selection phase becomes crucial, both conceptually and practically.

Images as data

Digital technologies brought to visual culture a quantitative change as well as a qualitative one. Besides being considerably more available than before, digital images are also inherently different from their analogue precursors: no longer are they produced with chemical processes, but rather they are the result of algorithmic work. «Soft image» (as opposed to hard image) is a term that captures the shift towards an image intrinsically merged with software (Hoelzl and Marie, 2015) in its production, fruition and circulation. The book «The Glitch Moment(um)» presents a «vernacular of file formats» (Menkman, 2011), or glitches, obtained by inserting errors in the underlying code of an image. In the artworks, the visual indicator of the error exposes the algorithmic make-up of one digital image.

The fact that images are soft also means that they are machine-readable, in that they are «in a form that a computer can process» (Machine readable, nd), or streamlined to be scanned by machines, often before they are seen by humans (Paglen, 2016). Operative images (Farocki, 2004), those «that do not represent an object, but rather are part of an operation» (p. 17), first confined to military settings (with machine vision technologies packed into unmanned missiles), or industrial production facilities (with mapping and object recognition), have recently flooded our cities to sustain a massive surveillance infrastructure. Today, most of the images online have been probably scanned by a machine and not necessarily seen by a human. If one

were to look into one of these «machine-to-machine seeing apparatuses», she would find a highly encoded flux of data, «a menagerie of abstractions that seem completely alien to human perception» (Paglen, 2016). Attempts have been made at putting humans back in the loop, theorizing ways of «seeing like a machine» (Ballvé, 2012), or designing ways to «peek inside these networks» (Mordvintsev *et al.*, 2015).

Facing an ever-growing (private-owned) seeing apparatus, scanning every bit of visual content uploaded online, one may ask: what is left for research? Do close-reading methods pale in front of the breadth of an inescapable seeing infrastructure? How can one carry out visual research in a computation-intensive society? The danger, for visual researchers too, is to approach the study of digital images armed with what James Bridle (2018) defines as «computational thinking», that is «the belief that any given problem can be solved by the application of computation» (Bridle, 2018). On the other hand, one response to the ubiquity of computational technologies in our visual culture, might specifically involve the repurposing of those same technologies for research goals.

Images as networked content

In the introduction of «The photographic image in digital culture» Martin Lister (2013) describes the move «from image to network» as the theme of the second edition of the volume. The shift could be characterized with the image studied as a web object served through an online interface, and with its (digital) materiality fading into the background. The move towards the network is also a move *outside* of the image, which begins to be studied alongside its digital context. That images are networked means they are to be considered «not as solitary objects, but as a part of a network of other images, users and platforms» (Niederer, 2018a). In the project «Reblogs or Context is the New Content», design researcher Silvio Lorusso (2015), visualizes «the trail created by a single digital image while traveling through a social platform». The project is a video montage of the same image, reblogged – to use the term of the platform – by Tumblr users on their personal page. To address the entanglement of visual, textual and numerical elements at play in a page online, the notion of «photographic document» (Neal, 2010) considers the image as only one part of a larger ecosystem of digital objects on offer for research.

There is in fact a diverse set of data that one can extract, or retrieve, from one single online image. A distinction may be made between the «mechanically captured metadata» and that generated from network activity such as tags, engagement metrics or timestamps (Rubinstein and Sluis, 2008). A fur-

ther classification differentiates external data (such as location coordinates and timestamps) from internal ones, extracted with digital image analysis techniques (Hochman, 2014). Another way of making a distinction is one based on data storage, with technical information (such as exposure, camera model and shot location) stored within the image file, whereas tags, captions and metrics are stored independently (Rubinstein and Sluis, 2013). Metadata, engagement metrics, tags and the likes render «the image as a calculable surface» (Ibid.), that can be measured, retrieved, or scraped.

Networked images are embedded into the platforms and websites that host them, and those platforms «have a particular way of formatting, prioritising, and recommending content» (Niederer 2018a). Indeed platforms' features stimulate particular communicative patterns, or platform vernaculars (Gibbs *et al.*, 2015), which result in the production of platform-specific content, such as «rants on blogs, tweet storms on Twitter» or «long-forms on Medium» (Rogers, 2017, p. 1). There have been empirical attempts at identifying platform-specific image formats, that are the types of images exclusively, or mostly, shared on a particular platform. To do so, classification of (preferably random) sampled content is used to distill the most-shared image types *in general* on one platform such as Twitter (Thelwall *et al.*, 2016) or Instagram (Hu *et al.*, 2014). Other approaches involve the study of one issue across multiple platforms. For example, one could study which images are used to represent “climate change” in different platforms: how does Twitter “do” climate change? How does Instagram? Do they offer an identical visual representation of the topic? Here «platform visual vernaculars» (Pearce *et al.*, 2018; Niederer, 2018a) are distilled by comparing the most-engaged-with images across platforms. One other proposal for a platform-sensible approach to visual research may involve the study of one single platform, its user affordances and their effects on the type of content produced, as proposed in one «Instagrammatics» agenda (Highfield and Leaver, 2016). The issue at stake is the recognition of a platform's technical features as actively shaping the content published on them (Niederer, 2018b). Generally, a networked approach to image research should not treat images as separate from their carriers.

Blurriness: multiple, unstable and mobile images

By definition, blurriness refers to «the quality of being indistinct and without sharp outlines» (Blurriness, n.d.). I define the blurriness of digital images, or loss of sharpness, with three terms: digital images may be characterized as *multiple*, *mobile* and *unstable*.

First, as a consequence of the aforementioned networked nature, digital images are ready to be linked to each other in *multiple* formations. On the web, an image rarely stands alone: hashtags, users, comments, and other metadata are there to group images with other similar images and generate multiple «imagined data communities» (Hochman, 2014). An image online is rarely served on its own, but rather «as strings, threads, sets, grids» (Lister, 2013, p. 8). Artist Penelope Umbrico provides an ongoing visual evidence of such multiplicity, enabled by metadata and other elements associated with an image online. Since 2006, she has presented sunset shots collected from Flickr in an ever-growing grid of almost identical suns. The title of the project is updated constantly with the numbers of results one gets from searching the word [sunset] on the platform. As of 2016, the title reads: 30,240,577 Suns (from Sunsets) from Flickr. The wall of multiple instances of the same object is a curated example of the infinite collections of similar images one could find online.

A second declination of blurriness refers to the *mobility* of digital images, in that they are seen on multiple sites and modified by users and platforms. One definition is the «poor image», that is a «copy in motion» (Steyerl, 2009) and loses its quality when downloaded, modified, reblogged, or turned into material for a meme. One could say that image-making has paved the way for image-moving as the main practice sustaining visual culture online. It is the advent of «circulationism», which is «not about the art of making an image, but of post-producing, launching, and accelerating it» (Steyerl, 2013). Another term is «ephemeral» (Hand, 2016), that captures the fleeting nature of digital visual content, often specifically produced to disappear after a period of time.

Thirdly, the meaning of digital images is unclear, or *unstable*, in that it repeatedly changes as images travel around. There is a continuous process of redefinition and reassessment of the meaning of the digital image: when images are tagged, liked or commented, meaning is continuously negotiated, making it the result of a shared and collective activity.

In relation to this instability, analyzing individual images might fail to address «important dynamics of visual social media, especially regarding fluid inter-textual meanings» (Hand, 2016, p. 220). If most of the images we encounter online are to be found in groups, is the study of individual images still a valuable approach? Furthermore, should casual and volatile ways of looking be matched with equally casual and volatile research methods (Lister, 2013)? What kind of visual analysis is needed to unpack a multiple, unstable and mobile image?

Towards the folder of images: studying images in groups.

The specific features of digital images require for an amended approach to their study. To describe digital images as mutable arrangements of content, available at an unprecedented scale and embedded in a larger ecosystem of users and platforms, entails to reconsider the methods that have been used up until now to study single, stable, scarce and enclosed images. Specifically, we need strategies that shift the focus from the individual image to the *group of images* as the unit of analysis.

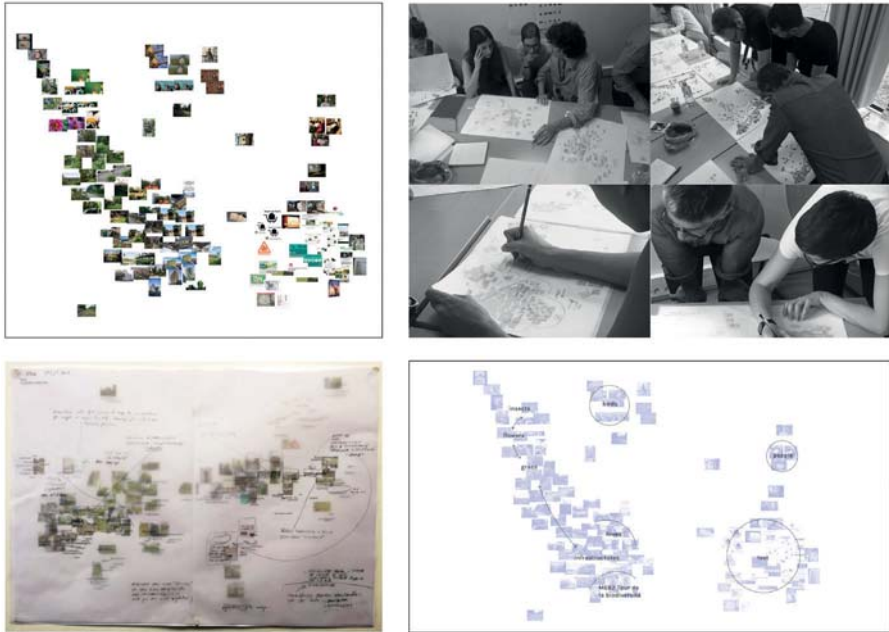
In a research setting for the study of images in groups, one begins inevitably with a folder of images. The scenario of use, to use a term from design research, is that of a folder full of images and their metadata which is open to interpretation. The folder of images is a metaphor to note the analytical shift towards the collection of images, but it also represents a very practical situation. After research questions are formulated, a list of sources compiled and content is located and collected, the research path ends with a collection of images saved in a local or shared folder. At this point, the need to look into the collection arises. How does one observe a group of images in a structured way? The folder, built-in to most operating systems, represents the most common interface for a set of images in a research setting, despite its limited display options, often limited to a grid or list of items. Research photo management softwares¹ usually offer enhanced functions (such as advanced search or easier image annotation), but do not provide new custom display options.

The study of digital images *in groups* should be supported by the design of *ad hoc* visual interfaces. As scholar Johanna Drucker (2010) has argued, visual models are far from being innocent, but rather embed specific ways of thinking. Relatedly, the design of tailored display solutions for a set of images may promote particular «ways of seeing» (Berger, 1972), while rendering difficult other lines of enquiry. For this reason, the ways in which a folder of images is displayed should not be limited to the options offered by available softwares, but rather carefully designed based on researchers' needs.

One proposition for the study of a folder of images is what I have termed «the design of composite images» (Colombo, 2018): a composite image is the result of the combination of multiple images into a new synthetic artifact,

¹ For example, the «Research Photo Management software» Tropy (Roy Rosenzweig Center for History and New Media, 2015), developed at the George Mason University, makes the management of research visual material easier, from annotation to advanced searching, yet it only allows users explore a collection of images in a regular grid (<https://tropy.org>).

that supports researchers' interpretative work. For example, a grid of images ordered by time of upload may be repurposed as a narrative format (Colombo and Azzi, 2016); layering dimmed images into one composite helps to summarize visual features (Pearce *et al.*, 2018; Niederer, 2018); or the organization of a set of images based on content similarity may be used to stimulate the detection of thematic clusters (fig. 1).



*Fig. 1 – In a research project concerned with the online mapping of the issue of urban nature (Ricci *et al.*, 2018), researchers, designers, and experts collectively interpret a composite image. Images from Twitter are grouped in the page based on similarity (top left), thus encouraging the detection of thematic clusters (top right). Researchers annotate their analysis on a second layer (bottom left), that is then summarized in a diagrammatic form (bottom right).*

Conclusions

In this text, I have argued for an approach to visual research attuned to the networked nature of digital images. Specifically I have made the case for the analysis of collections of images as opposed to individual ones. I have then argued in favor of the design of *ad hoc* interfaces for the analysis of

such collections. The rationale for this proposal is the acknowledgment that to study a radically new kind of image, digital and networked, we also need to design a new type of image. One that is able to aggregate and recompose multiple and frameless formations collected online into stable artifacts open to inspection.

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The Materials Generation

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Abstract

The DIY movement is expanding beyond products to include the materials from which the products are made; namely, DIY-Materials. Designers around the globe are engaging in different experimental journeys encircling the materials development field before developing their projects. Self-made material sources are providing designers with a unique tool to develop new languages and new products with original and fresh materials experiences. As more designers take this path, a proper study around the phenomenon needs to be carried out.

This chapter presents an introduction to a doctoral study conducted to understand the DIY-Materials phenomenon as one of the emerging materials experiences in the field of design. The herein presented research structure shows the formulation of research questions and hypotheses, the qualitative methods and strategies to conduct the different tests, and how the different elements are attempting to clearly define this phenomenon together. The chapter does not act as a summary of the study. Instead, it is an invitation to read the doctoral dissertation. Within, it is possible to view and understand the opportunities DIY-Materials offer when considered as a possible practice in the design domain.

Introduction

Nowadays, the products surrounding us derive primarily from industrial materials, i.e., materials that are developed in order to answer mass production requirements and constraints. And it does not look like it will be chang-

ing any time soon. However, it is observable that over the last few years, another interesting phenomenon has emerged, bringing a new dimension to the relationship amongst designers, technologies, production processes, and materials. It is known as DIY-Materials (do it yourself materials) to highlight the principal characteristic of this “new class” of materials, which are conceived by the designer and their development is characterized by a tinkering approach and a self-production process (Rognoli *et al.*, 2015). This new approach to materials development is enhanced by the renaissance of craftsmanship, by the democratization of the technologies and all the practices combining making, crafting and personal fabrication (Bettiol and Micelli, 2014; Tanenbaum *et al.*, 2013).

The DIY movement expands beyond products to include the materials which make the products (Brownell, 2015). Starting from the DIY-Materials definition which describe these materials as created through individual or collective self-production practices, often by techniques and processes of the designer’s invention (Rognoli *et al.*, 2015), we decided to add to the doctoral research we are presenting, the social innovation perspective, with the idea to better frame this remarkable and contemporary phenomenon.

The DIY-Materials Phenomenon

DIY practices are taking on different fields of knowledge and expertise. Among these, the materials for design domain is increasingly witnessing designers making use of this practices. In our opinion, it happened for several reasons including the interests related to more sustainable futures and attention to the social innovation perspective. Furthermore, the designers who have embarked on a path of development and self-production of materials, they also wanted to demonstrate their dissatisfaction with the monotonous uniformity of the industrial material landscape, and therefore they tried to generate original material experiences, even transforming themselves into real activists (Ribul, 2013) against the mass-production system. It seems that designers enjoy regaining control of the ideation and production processes, getting their hands dirty by experimenting with colors, textures, consistencies, mixing various ingredients and having fun looking for alternative and unconventional sources as raw materials.

DIY-Materials practices promote knowing in action (Schön, 1983), i.e., experiential knowledge with and through materials. The outcome of this process is often a self-produced material as a result of making things by hand, but also by thinking through the hand-manipulated materials (Nimkulrat,

2012). Thus, the process of making materials by hand can be identified as a way of thinking intellectually (Sennett, 2008) and a way of tinker manually (Parisi *et al.*, 2017). Designers, furthermore, require a dynamic process of learning and understanding through material experience (Gray and Burnett, 2009, p. 51) for designing with materials (Karana *et al.*, 2015).

The study began by asking: what is the origin of DIY Materials? Moreover, what can serve as a material source for their development? As there exists only a limited amount of literature in the emerging field and several types of research being applied on the subject around the globe, it was crucial to propose a more in-depth categorization and theory structure. There is a high chance for this phenomenon to continue to grow and become established, creating balance within the materials domain.

Theoretical requirements

The theoretical background of this study is composed of three macro-areas of research: materials for design theories, DIY practices, and design for sustainability (fig. 1). Through these three macro-areas, there is an opportunity to connect other significant theoretic contribution like the concepts of materials experience, the autarchic approach to materials and technologies (De Almeida Meroz, 2014; Bosoni and De Giorgi, 1983), and the circular economy principles and social innovation research.

The principal aim of this dissertation is to illustrate the possible paths for these areas to encounter. The study underlines the three agendas and topics coherently but does not intend to force the merge of the three topics as a whim or just for the sake it. Instead, it highlights the opportunities occurring when these topics encounter one another.

Motivations

Considering the evident connections that may emerge between the three macro-areas of research, examining also the relationship between people and things (material culture studies¹), how human beings relate to their environ-

¹ Material Culture & Ecological Anthropology are defined by Ingold as recently opposite schools of thought. However, in this dissertation there are several moments in which both fields meet. Ingold, T. (2012). Toward an Ecology of Materials. *Annual Review of Anthropology*, 41, 427-42.

ment (ecological anthropology), and the issues of maintenance of the society and the planet (sustainability), the doctoral study focuses on the connections between topics and opportunities for the future of design materials.

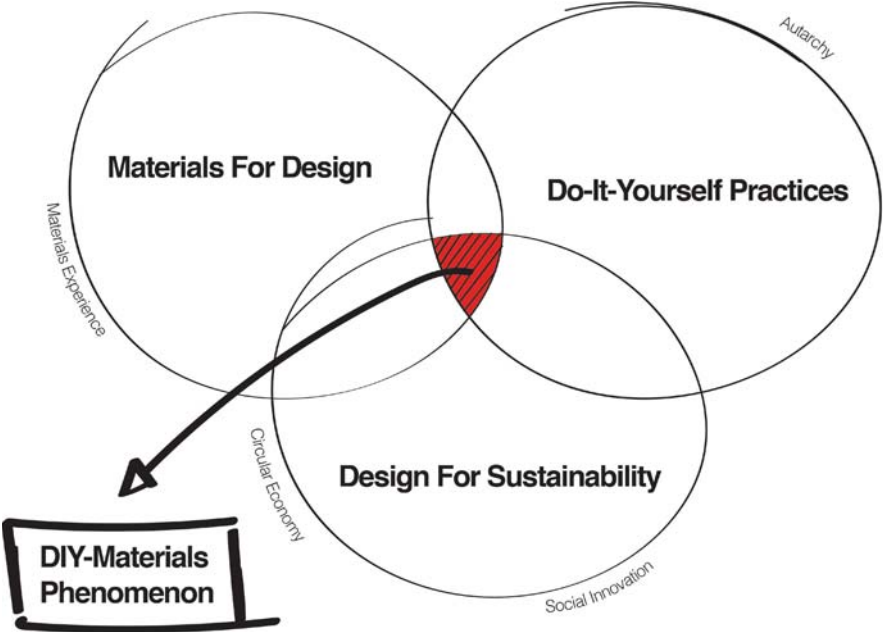


Fig. 1 – The three macro-areas that determine the theoretical support for the DIY-Materials phenomenon

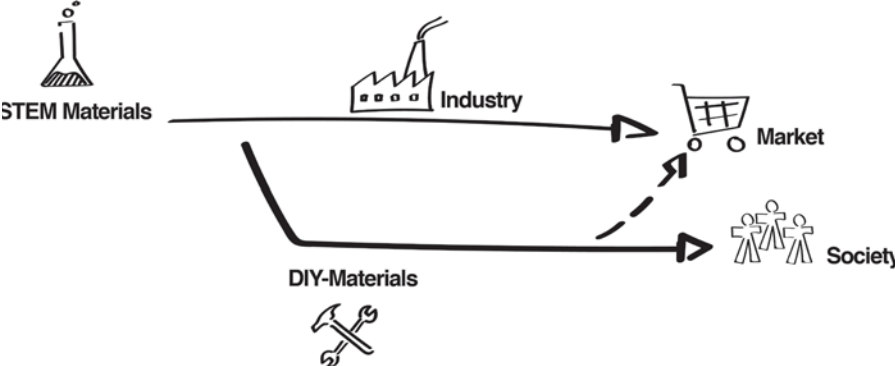


Fig. 2 – DIY-Materials as an alternative to traditional materials developed by science.

Societies need a driver which allows social innovation for the material culture. There is, and there always will be a technological innovation that is driven by the development of science and technology continuously investigating intelligence in materials (e.g., nanotechnology, memory, self-transformation). Nevertheless, materials in science always have the problem of accessibility, which means neither designers nor communities can gain quickly access to those materials that are developed in the lab. Unfortunately, some decades will have to pass before it will be possible to buy them in standard formats in a store.

This study focuses on another possible path for materials development and accessibility (fig. 2).

Humans beings must find alternative ways not only to produce but to use and dispose of materials.

Do-it-yourself practices, which arise as a social movement and which will presumably lead to social change, are now focusing on materials. It is a growing trend that we believe requires an ever-increasing study and investment.

The research questions

The research questions, sub-questions and the hypotheses guided the different stages of the research. One main question remained instrumental in guiding the process.

Research Question (RQ1)

What causes the DIY-Materials Phenomenon?

As it is a broad question that can be interpreted in many ways and can lead to many different results, the formulation of three sub-questions provide a more detailed focus:

- (a) **Who** decides to embark in a DIY-Materials development?
- (b) **Why** do people decide to do their materials?
- (c) **What** are the differences between DIY-Materials and other materials?

This research question and its sub-questions helped to organize a research method and with it, a systematic collection of cases and best practices of this phenomenon.

After the findings obtained by developing a categorization of the different cases (Ayala-Garcia, Rognoli and Karana, 2017), a second research question emerged. It was evident that by determining the causes of the phenomenon and the reasons why people do materials will not provide enough contribution to the field of study. The questions of “what” and “why” needed to be expanded upon. They helped to create a better description, and surely the classification became an essential element for a better comprehension of the phenomenon. Nevertheless, if the phenomenon continues to grow, as it certainly did since the start of the doctoral research to the writing of this chapter, it was essential to explore where it would go. What difference could it make compared with traditional materials developed by STEM (science, technology engineering, and mathematics sciences)?²

On the evidence proved by the initial studies, where the essential knowledge on crafts is a determinant for a designer to embark on a materials development, the second research question shaped the rest of the doctoral study.

Research Question (RQ2)

Who can generate a DIY-Material?

Many artists, architects, and designers who have developed a material come either from a family of craftsmen, are trained to approach materials through their higher education or are DIY enthusiasts and believe in the open source and maker movements. This insight creates a niche inside the entire design field putting the willingness and capabilities to craft in the first place. All those with no intention to make with their hands will be hypothetically taken out.

Research objectives

General Objective

Develop a theoretical framework which allows the practice of DIY-Materials development to become available and implemented by a broader design audience.

² STEM is a term first used by the U.S. federal agencies to call the core sciences in the field of education for funding scientific research. Gonzalez, H., and Kuenzi, J. (2012). *Science, Technology, Engineering, and Mathematics (STEM) Education: A Primer*. Congressional Research Service.

Specific Objectives

The first objective is to highlight the possibilities that DIY-Materials can provide when considered as a possible practice in the field of design.

The second objective is to find and define a proper set of guidelines that can be utilized by a person who wants to develop a project starting from the material.

Key Words

- DIY-Materials
- Emerging Materials Experiences
- Tinkering with Materials
- Expressive-Sensorial Characterization of Materials
- Experiential Qualities of Materials
- Materials for Design
- Democratization of Materials

The research hypotheses

Theory building starts with propositions and hypotheses, where relationships among variables emerge. A series of hypotheses were proposed to guide the studies finding information to measure and encounter tendencies towards materials development patterns. According to Kaplan (1964), there are working hypotheses and test hypotheses. Working hypotheses serve to guide and organize the investigation providing something to go on with (p. 88).

In this research, the study started with two working hypotheses:

Working Hypothesis (WH1)

The DIY-Materials phenomenon tends to grow. There should be a way to organize it to allow a better understanding.

Working Hypothesis (WH2)

DIY-Materials emerged from the creative fields of humanities. There should be a gap that traditional STEM materials are unable to fill.

Test hypotheses on the other side come after the investigation is already on track. A series of inquiries may emerge to find the solution to a posed problem.

After being able to understand how in all the cases studied, it was of extreme importance to gain certain degree of familiarity and ability to work

with the hands to develop a material, a set of test hypotheses emerged providing further directions for the research. The test hypotheses suggest:

Test Hypothesis (TH1)

There is a relationship between knowing how to craft things and materials development.

Having concluded that classifying and organizing materials into different categories and sub-categories provides information about common elements the different cases share, a further observation on similar aesthetic patterns, common motivations and drivers to obtain a better understanding of the phenomenon emerged. A second test hypothesis then suggested:

Test Hypothesis (TH2)

Starting material development from a particular source has an effect on the final material developed.

If any DIY-Materials development starts from a particular kingdom, the designers of the material could carry out a focused research gathering information from similar cases understanding common elements, limitations, and advantages concerning properties and qualities of the material they want to develop as well as the benchmark ones.

Finally, another critical conclusion from the exploratory studies revealed that the designers unlike material scientists and engineers had some different motivations. Designers driven by concerns around sustainability and new aesthetics, propose alternatives for what the mass market provides. The third test hypothesis suggests:

Test Hypothesis (TH3)

DIY-Materials were the result of motivations other than what STEM materials commonly have.

The results would be different from what currently exists in the market not regarding performance and capabilities, but regarding what they have to offer to potential users.

The necessity to perform a fourth study followed the evidence of the potential for a DIY-Material to go further. The fourth research hypothesis allowed to move forward from the tinkering approaches which characterized

the third study into a more organized and accurate procedure. The fourth test hypothesis suggests:

Test Hypothesis (TH4)

DIY-Materials can achieve a mature level of qualitative development and it is possible to analyze them with standard methods to reveal qualitative data.

With the combination of data, it is possible to propose paths towards an application. To see the relationship between the proposed research questions, the hypotheses and the studies addressing both questions and hypotheses refer to fig. 8.

The structure of the doctoral dissertation

The dissertation consists of four main parts (fig. 3). There is the initial part where we provide an introduction and overview of the research as a whole, focusing attention on the organization and development of the study.

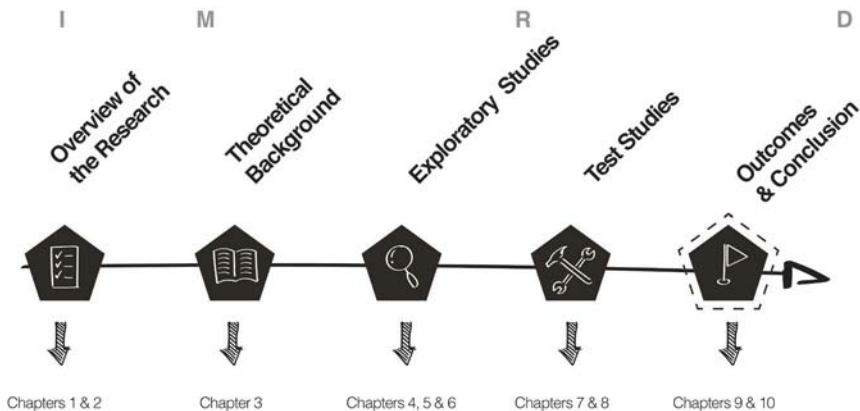


Fig. 3 – Structure of the Ph.D. Dissertation.

After that, we introduce various theoretical backgrounds and macro areas of research: materials for design, DIY practices, and sustainability-related theories. After that, we present the exploratory studies conducted to better understand the DIY-Materials phenomenon and start to define it. This part is composed of three exploratory studies: cases studies and best practices collection and their categorization, evaluation and aesthetical evaluation of

DIY-Materials. The following section presents the test studies conducted to validate hypotheses and gather insights for developing a DIY-Materials theory. This part is composed of two test studies: DIY-Materials development level I and DIY-Materials development level II. After the test studies, we illustrate the outputs of the different investigations, recommend a roadmap for the efficient development of a DIY-Material with a test study and present two strategies for the dissemination of the DIY-Materials theory. Finally, we discussed the research conducted, highlighting potential opportunities for the future of this phenomenon together with a report of activities, dissemination work and credits to all designers who participated in the study.

The doctoral dissertation is structured in such a way that it can be read continuously or separately according to the reader's interest. Each section stands by itself and contains references to connect and search for specific background topics in the other sections if needed. Regarding the theoretical background and introduction, the entire literature review is summarized and focuses on the different macro areas of research to better connect with the whole investigation.

The dissertation contains a series of figures and tables developed to facilitate the reader's understanding of the whole manuscript, support the introduction of concepts and enrich the research with visual aids. The numerous cases studied, the different evaluations and some of the work by the participants are made visible in a series of composed boards. By doing so, the focus of the visual aids goes to the materials and not to the product or a specific application. An appendix with various additional information, a number of examples of data collection, questionnaires and materials samples mark the final sections of the doctoral research.

Research Methodology

The whole PhD dissertation is composed of an explorative phase and a test phase. It builds upon several empirical studies aiming to produce a better understanding of the DIY-Materials phenomenon. Support from the different studies comes from the concepts of project-based research (Zimmermann, Forlizzi and Evanson, 2007). When studying a material from a designer's perspective the means by which to do it not only serve to explore the proposed theories physically but also allow for the description of the whole development afterwards. This method is known as design practice.

As DIY-Material practices promote knowing in action (Schön, 1983), which is a contemporary way of doing research (Mäkkela, 2007) artists and designers connect themselves with the field of research establishing a practice-led investigation. By looking at the different processes and the work produced through them, it is possible to acquire not only the skills but also the knowledge of the practice. This focus is the central constituent of the DIY-Materials theory.

Building blocks for a possible DIY-Materials Theory

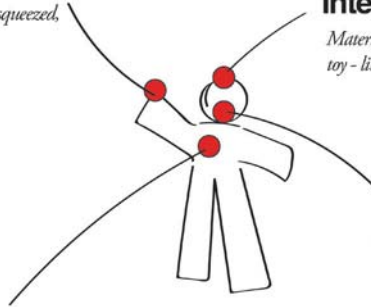
Materials knowledge is a crucial element in the field of design. Designers understand physical properties and interact with qualitative attributes of materials all the time when developing products. Some designers are more aware than others about the role of a material in the products and can create meaningful experiences combining attributes of the product with the attributes of the materials that make it possible. Ezio Manzini provides an important definition to this matter by saying “Matter becomes material when it is included in a design project and becomes part of the product” (Manzini, 1986, p. 17). This definition can be considered a pillar in what is known today as materials for design, a section in the materials domain that moves away from the technical and complex understanding of materials in STEM (Science, Technology, Engineering and Mathematics) disciplines and concentrates on the experiential and behavioral interactions between people and the products. Recently in this section of the materials domain a concept known as the material experience appeared which defines the “experience that people have with and through the materials of a product” (Karana, Pedgley and Rognoli, 2014). This materials experience is rooted in a broader concept known as the product experience. Scholars proposed a framework to highlight how the relationship between user and product is mediated by three levels of experience: sensorial, emotional and meaning (Desmet and Hekkert, 2007). The concept of materials experience incorporates these three levels and adds a fourth one: the performative level (Giaccardi and Karana, 2015). The four levels affect each other and define the different experiences people obtain when interacting with a material (fig. 4). The materials experience concept and framework are quite broad and observable from different perspectives. One particular side of the materials experience, one that is relevant to this study, deals with the observation and understanding of three contemporary situations concerning materials that are impacting the field of design: dynamism, imperfection, and self-production.

Performative Level

Materials can be scratched, squeezed, hit, pushed, moved, etc.

Interpretive (Meaning) Level

Materials can be feminine, modern, traditional, toy-like, elegant, etc.



Sensorial Level

Materials perceived as cold, shiny, rough, heavy, opaque, etc.

Emotional (Affective) Level

Materials make us feel surprised, bored, disappointed, excited, disgusted etc.

Fig. 4 – Four experiential levels how materials are experienced. Interpretation from the materials experience framework (Giaccardi and Karana, 2015).

Research strategies

As mentioned above, there is an opportunity to connect Materials Experiences research, Do-it-Yourself practices and autarchic processes research with Sustainability issues related to circular economy principles and social innovation research. These three topics became the three macro areas, and the intersection between them guided the investigation throughout the doctoral studies. To connect the three macro areas of research and derive an original and well-funded theory, a selection of two strategies for the first part and five strategies for the second part of the study improved as a crucial element (fig. 5).

The first part addresses the understanding of the phenomena of DIY-Materials that have emerged in the past decade and are growing exponentially. It was essential to understand why designers have embarked on this particular way of creating materials instead of selecting existing ones and, most importantly, how they do it. Cases Studies (Stake, 2000) helped to create a proper categorization of DIY-Materials into Kingdoms and Secondary Research (Booth *et al.*, 2008, p. 76) allowing to analyze the different cases inside each kingdom while gaining qualitative data from each material.

The second part was devoted to testing the initial categorization working as a guideline to train designers to develop DIY-Materials. The course

entitled “Designing Materials Experiences”³ was created to test the theories and hypotheses of this doctoral study not with an academic focus, but with a practical one, as it was important for this study to collect more samples developed within a controlled environment and compare them with the ones from previous studies. With a total of 97 participants from 32 countries in the first edition and 81 participants from 29 countries in the second edition, it was possible to develop a robust study. The methodologies applied in this second part include Creative Toolkits (Sanders and Colin, 2003), Prototyping (Martin and Hannington, 2012, p. 138), and Storytelling (Beckman and Barry, 2009; Salomon, 2010; Giovagnoli, 2013).

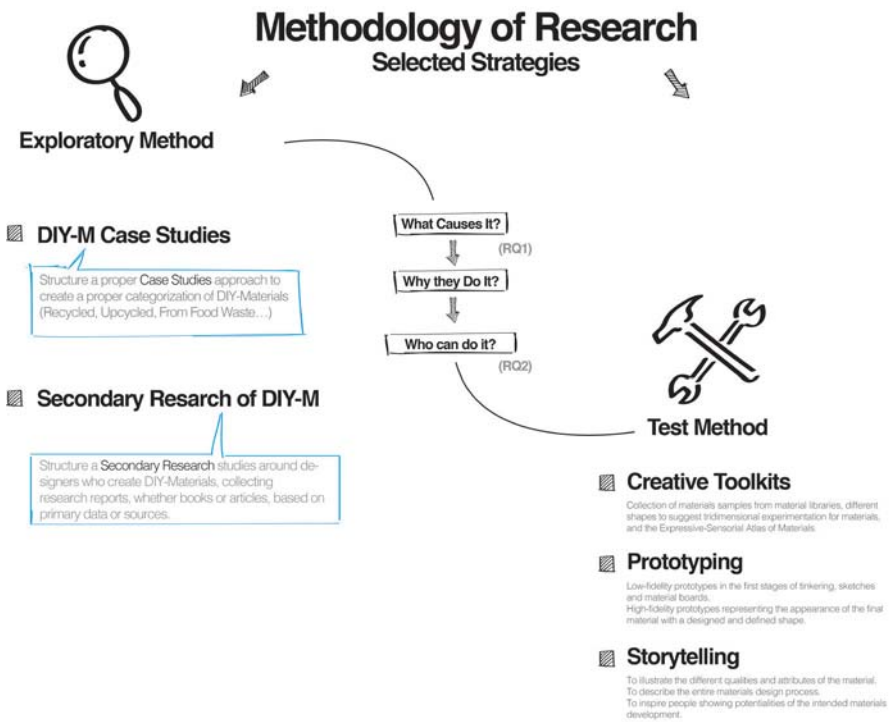


Fig. 5 – Methodology of research and the strategies performed during the studies

³ Elective course at master level held at Politecnico di Milano academic year 2017-2018.

Exploratory method

For the exploratory studies, the two selected strategies are:

Cases studies

Case studies are one of the most common ways to carry out qualitative research. According to Robert Stake (2000, p. 437), there are three types of case studies: intrinsic, instrumental and collective. For this investigation, the collective case study strategy was more suitable, as it is a way to understand individual cases and recognise how some common characteristics manifest. Studying a collection of cases is believed to provide a better understanding of a phenomenon, population or general condition. It led to a better theorization of the research.

Secondary Research

Secondary research allowed for the analysis of the different cases inside each kingdom grasping qualitative data of each material. Different from primary research which implies a closer contact with the study subjects, secondary research allows for the collection of information from a variety of sources (Booth *et al.*, 2008, p. 76). This strategy, together with the instruments for gathering information, also helps to suggest research directions to follow during the study.

Test method

For the test studies, the three chosen strategies are:

Creative toolkits

Understood as collections of physical elements conveniently organized to inform and inspire design and business teams (Sanders and Colin, 2001), this method allowed participants to gain familiarity with materials, understanding them by physical interaction instead of face-to-face lectures, typical in materials science. To this aim, different elements were introduced during the third and fourth study, as a collection of material samples from the “Materioteca” the material library of the Politecnico di Milano, shapes to suggest tridimensional experimentation for materials, and the Expressive-Sensorial Atlas of Materials (Rognoli, 2005) – an educational tool aimed at helping designers study the sensorial qualities of materials as a translation of engineering properties.

Prototyping

Prototyping is the physical creation of artefacts at various levels of resolution, for development and testing of ideas within design teams and users (Martin and Hanington, 2012, p. 138). A prototype allows testing physically different attributes of the designed element, in this case, the material. Transforming the material sample into a prototype means that some shapes, textures, finishes, and volumes become subject of study. This type of samples is critical not only to the designer but also for users to understand the intentions and features of a material.

Design prototypes are defined by their level of fidelity or resolved finish. Low-fidelity prototypes appear in the first stages of tinkering accompanied by sketches and material boards. High-fidelity prototypes are more refined, often representing the appearance of the final material with a designed and defined shape. The participants are encouraged to move away from the standard flat, two-dimensional form of a material sample and test the material through prototyping in three-dimensional shapes with multiple textures and colours. Contrary to what scientists usually do, trying to minimize variables, here designers test any possible skill acquired in their career, achieving unique results in every single prototype. The portfolio of material samples becomes incremental, and the tools for storytelling and envisioning become more productive and more stimulating.

Storytelling

Storytelling is at the very heart of human cognition, of the interactions of individuals with one another and of the development of cultures in which humans thrive (Beckman and Barry, 2009). The field of design uses storytelling as a tool to describe the entire design process. It is used to inform the current stage of the project, or it is used to tell a new story, inspiring people by showing the potential of the intended proposal. When it comes to materials development, both types of stories can become handy in illustrating the different qualities and attributes. Through the dissertation, it is possible to see different case studies with the designers telling the story of how they achieve a particular material and the whole meaning of this achievement. Others focus on how this material can open doors to new possibilities for parallel applications to contrast the current state of product development and mass consumption.

During the study, the participants received training in the different possibilities of what a story behind material development can do. This method allowed all teams to collect various data from the very beginning and organize it according to what the material vision proposed.

Research plan

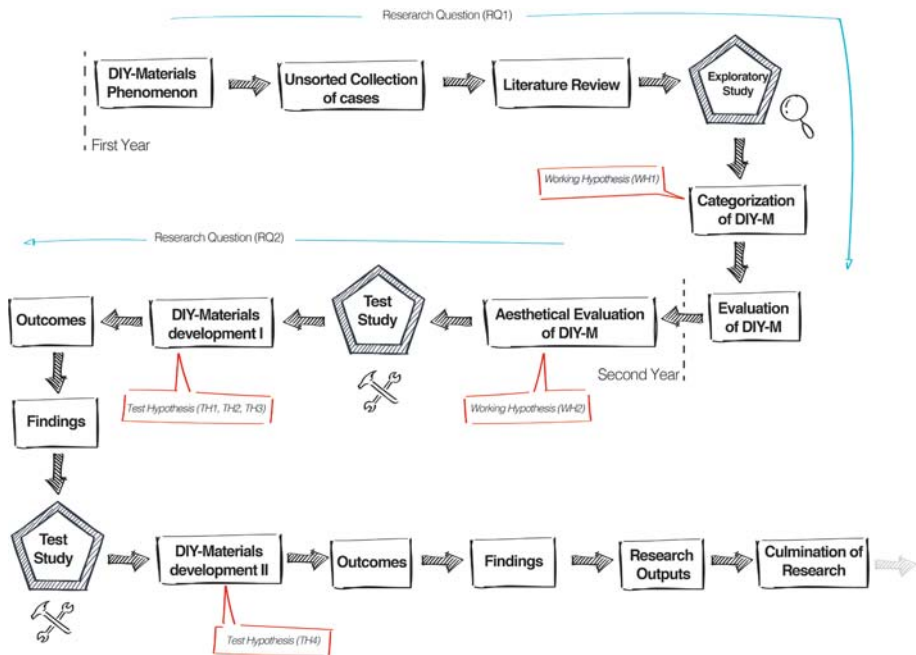


Fig. 6 – Graphical visualization of the research path.

Structure

The investigation was conducted first by understanding the theoretical background which was divided into the three macro areas of research. The analysis of the different elements of this theoretical background and the points of convergence resulted in the formulation of the first research question (RQ1). To answer this question an extensive collection of cases and an in-depth analysis of them began to give the research a sense of order.

Different classifications and evaluations of the various cases studies collected became these exploratory studies:

- **Pre-Study.** Collection and analysis of 150 cases of DIY-Materials. This study resulted in the classification of cases by kingdoms and is published under (www.diymaterials.it). The cases studies are continuously updated in the open source database and analyzed to extract qualitative data. By researching case studies in journals, blogs, websites, articles

Vegetabile



Sugaring Sugar
relia Deshoeyers



Pinecone
nas Edvard & Nikolaj Steinfatt



gaery
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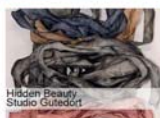
Beehive
omas Libertiny



From Insects
Mariane Huisoud



Bioculture
Suzanne Lee



Hidden Beauty
Studio Güteldort



Ruminant Bloom
Julia Lohmann



Coleoptera
Aagje Hoekstra



Cooked Wood
Freyja Sewell



Hair Highway
Studio Swine



BioElectric
Jeongwon Ji



Tanned Leather
Lina Patsiou

Lapideum



Marble
Marco Guazzini



Transience x Transnatural
Lex Pott



Oxidation Aftermath
Handmade Industrials



Salt
Roberto Tweraser



Blueware
Gilthero



Dust Matter-s
Lucie Libotte



Ballon Bows
Maarten De Ceulaer



Improvisation Machine
Annika Frye



Stone Spray
A. Kuik, I. Shergil, P. Novikov



Color Casting Concrete
Ungyun Iwamura

Recuperavit



Fruitleather Rotterdam
Woka Alumni



Eggo
Sebastian Aumer



Decafe
Raul Lauri



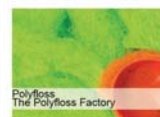
Apel
Alkesh Parmar



Fos Project
Octavi Sierra - Clara Romani



Sea Chair Project
Studio Swine



Polyfloss
The Polyfloss Factory



Can City
Studio Swine



The Meat Project
Atelier Monte



Impasto
Nikolaj Steinfatt

Mutantis



MixD
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Magnetic Fabrics
Lilian Dedio



Gravity
Jolan Van der Wiel



Original Stools
Breaded Escalope



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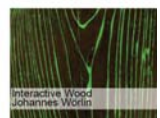
Wooden Textiles
Buro Belen



Green
Sebastian Straatsma



FL Air
Alix Huschka



Interactive Wood
Johannes Worlitz



Transformative Paper
Florian Hundi

Fig. 7 – Categorization of DIY-Materials into Kingdoms.

and exhibitions, we began to think of these examples and their unique qualities. We started to create groups of similar items. Since the classification of objects means to combine them into categories based on common elements, we drove the focus on a possible categorization for the DIY-Materials. We look for inspiration in the first biological classifications of the XVII century (e.g. the work of the Swedish botanist, zoologist and physician Carolus Linnaeus called *Systema Naturae* (Linnaeus, 1740). Linnaeus published what became for many years the standard biological classification of elements of earth, known as the Linnaean taxonomy. This landmark publication established a hierarchical classification of the natural world, dividing it into three main kingdoms: plant, animal and mineral. However, the original taxonomy provided by Linnaeus inspired us also in naming the DIY-Materials categories (fig. 7).

1. ***Kingdom Vegetabile:*** When the primary source for a DIY-Material derives from plants and fungi, we categorize the material under the Kingdom Vegetabile.
 2. ***Kingdom Animale:*** It refers to all material sources derived from animals and bacteria. Those materials can be developed either by collaborating with living organisms or by using parts of the animals, like hair or bones.
 3. ***Kingdom Lapideum:*** It contains all DIY-Materials, which come from minerals: stones, sand, ceramics, clay, etc. Some current cases combine sources from other kingdoms, such as wool or cotton fabrics, but in a lower percentage compared with the main constituent.
 4. ***Kingdom Recuperavit:*** comprise all sources society consider as waste but have the possibility to transform into a valuable resource. They often come from plastic, metal or organic waste, sometimes as side products of industrial production.
 5. ***Kingdom Mutantis:*** includes the DIY-Materials created from different technological mixes and hybridization of industrial, interactive or smart sources.
- ***Study One.*** Evaluation of the different cases studied with specific instruments allowed information to be gathered regarding the various motivations behind the creation of such types of materials.

- **Study Two.** Basic research on aesthetic qualities of the DIY-Materials classified by kingdoms. By gathering different qualitative tools and theories from various scholars, it was possible to establish an initial evaluation of the aesthetic and sensorial characteristics of these materials. This evaluation allowed for a better understanding of possible similarities and general characteristics of a kingdom.

With the exploratory studies concluded, the formulation of a second research question (RQ2) guided the second group of studies. Two courses at the M.Sc. level and five master thesis projects developed under strict guidelines provided the necessary data to move forward in the proposition of a DIY-Material theory. An additional research question (RQ3) emerged between studies aiming to find additional insights and organize the findings into what could be the primary outcome of the research. This second group of studies became the following test studies:

- **Study Three.** A course developed specifically to test the theories and methods gathered to create a material under guidance. Two editions of the proposed study happened during the research plan and provided insights to validate hypotheses.
- **Study Four.** Added another layer into the development process creating a series of incremental steps for advanced DIY-Materials development. Five participants from the previous study with the potential to develop an M.Sc. thesis on DIY-Materials were selected. Their topics for thesis work and their investigation were guided to prove hypotheses and provide additional information for the DIY-materials theory.

The different research questions, hypotheses and the related studies in correspondence with the chapters of this dissertation are visible in fig. 8.

Context

The overall research was conducted in an academic context first by analyzing the phenomenon of DIY-Materials within the design field and with empirical research tools known in the design domain. Subsequently, the test studies took place within the design department of the Politecnico di Milano, and all participants were Master students. They accepted to be subjects of research and agreed to share their findings and contribute to the theory's for-

Study	Research Question	Hypothesis
Pre-Study	(RQ1)	(WH1) - The DIY-Materials phenomenon tends to grow. There should be a way to organize it to allow a better understanding.
1st Study	(RQ1) What causes the DIY-Materials Phenomenon?	(WH1) - If DIY-Materials emerged from the creative fields of humanities, then there is a gap that traditional material related sciences are unable to fill.
2nd Study	(RQ1)	(WH2) - If somebody who knows how to craft things get additional knowledge and guidance about how to perform a materials development, then he or/she can produce a material sample of any kind.
3rd Study		- Starting material development from a particular source has an effect on the final material developed.
	(RQ2) Who can generate a DIY-Material?	(TH1)(TH2)(TH3)(TH4) - DIY-Materials were the result of motivations other than what STEM materials commonly have.
4th Study		- If DIY-Materials achieve a mature level of qualitative development, it is possible to analyze them with standard methods to reveal qualitative data and with the combination of data propose possible paths towards an application.

Fig. 8 – Overview of studies with focus on research questions and hypothesis.

mulation as presented in this dissertation. Although the whole investigation was conducted and analyzed within academia, the different outcomes of this dissertation have the potential to be explored outside an academic environment through the various streams proposed.

Intended Outcomes

The dissertation presents the different achievements of the doctoral study, aiming to better understand the phenomenon known as DIY-Materials. A theoretical background based on a taxonomy of the different materials collected allows for the interpretation of the motivations behind the designers who create those materials and will seek to establish directions for this type of developments.

A practical method composed of a series of steps which allows for the development of DIY-Materials with a high level of quality is considered as an outcome of this investigation. The second part of this dissertation which is called the test phase shows an in-depth explanation of how the different subjects of the study experienced a DIY-Materials development process. During this process, participants produced a series of samples following different directions and methods.

An open source database with the results of both explorative and test phases is available to anyone who decides to replicate a material, propose a new alternative or continue the development of material given a specific application. The PhD started by collecting cases and moved towards the creation of new ones. By building a database organizing previous cases and newly developed ones together and in a visible manner, the investigation will open the doors for more designers to perform and develop these new emerging materials experiences.

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In October 1998, on the occasion of the first conference on design education, Richard Buchanan, then Director of The School of Design at Carnegie Mellon University, envisioned doctoral education in Design as a “neoteric enterprise”, aimed at finding novel ways of addressing the new problems, “thereby creating a new body of learning and knowledge”. Twenty years after, these words can still be shared: the *new problems* affecting our globalised, bewildered and worried society are growing in numbers and in complexity, and *novel ways* of sorting them out are more sought-after than ever.

The present book is part of a series that, since 2017, documents the production of the Politecnico di Milano Design Programme, presenting a summary of the doctoral theses defended each year. Eleven essays are here gathered into four sections: Design Education; Collaborative Processes; Cultural and Creative Companies; Technology for Social Change.

In the variety of the researched topics, a common trait can be found in the continuous need of updated ways of addressing complex problems. It is such need that drives the evolving boundaries of design research forward, not just within our Doctoral Programme, but within all the national and international Doctoral Programmes in Design we are acquainted with.

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