

## DESIGN INTERNATIONAL SERIES

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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.

The current expansion of the educational network allows teachers, students, researchers and professionals to meet, both online and in person.

It would seem therefore that the time is now right to propose a new series of books on design, contributing the construction of the international design community, helping authors bring their work onto the world scene.

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.

Different areas of design will be investigated, such as for example: fashion, interior design, graphic design, communication design, product and industrial design, service and social innovation design, interaction design and emotional design.

Books published in this series are selected by the Scientific Board and submitted to two referees for peer-review.



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# DESIGN RESEARCH IN THE DIGITAL ERA

Opportunities and implications  
Notes on Doctoral Research in Design 2020



edited by Lucia Rampino and Ilaria Mariani

D. | . **FRANCOANGELI** OPEN  ACCESS  
DESIGN INTERNATIONAL

ISBN: 9788891799913

ISBN e-book Open Access: 9788835100317

*Cover by:* Ilaria Mariani

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Printed by Logo srl, sede legale: Via Marco Polo 8, 35010 Borgoricco (Pd).

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## **Designing in an era of transformation comes with responsibility**

*Lucia Rampino and Ilaria Mariani  
Department of Design, Politecnico di Milano*

The PhD in Design at Politecnico di Milano was established in 1990, exactly 30 years ago. It was Italy's first PhD Programme on the topic, and its leading figure was Ulm School of Design former teacher and director Tomàs Maldonado. Its original name was "Doctoral Programme in Industrial Design and Visual Communication," which showed the discipline's traditional legacy as being concerned with the technical study of two-dimensional and three-dimensional artefacts. The thematic areas covered were theory and history of design, product design, visual communication and environmental issues (Pizzocaro, 2003, p. 174). The programme partly acquired its initial approach from being situated in an increasingly complex framework, where innovation was relevant. This fuelled a need to consider the importance of design providing competitive advantages. Hence, in the first years, research themes were focused on the theoretical investigation of innovation-related phenomena (Pizzocaro, 2003). The strict relationship with the architecture field was evident. As a matter of fact, in Italy, the design was born from within the architecture discipline and only recently broke free of it.

From its 1990 foundation, when it hosted two candidates, our PhD Programme has grown significantly in size and has extensively enlarged the range of subjects covered. Now, 20 students join the Programme annually, entering a 250-strong Department, which is Italy's largest design research and education institution, and one of the largest internationally. Both the Department and the PhD in Design programme, welcome International members, embracing the cultural enrichment they bring.

Over its 30 years of PhD in Design, 231 theses have been discussed, and just as many candidates obtained their doctorate. By looking at the evolution of the addressed topics, it emerges that design research at Politecnico is no longer a matter of interior spaces, furniture, artefacts and their users, mass

production or technological advancements. Although the emphasis on conducting innovative research at a social, technical and organisational level is maintained, an updated perspective has consolidated. It reaches out to multiple disciplines and new issues, ranging from sustainability, design thinking, artificial intelligence, creative industries, and design ethics. If we initially systematised the Degree Courses' addressed topics based around the Degree Courses offered from our School – Product and Service, Fashion, Interior, and Communication – such a scheme has become blurred and obsolete. Throughout the PhD theses, the borders between the sub-fields faded, showing a rooted inclination to integrate and hybridise perspectives, towards more inclusive and crossbred ways of looking, studying, and framing our discipline.

To underline such a broadening of disciplinary focus, in 2009 the name of the Programme was changed from the original “Doctoral Programme in Industrial Design and Visual Communication” into “Doctorate of Research in Design”, or more informally “PhD in Design.” Our PhD demonstrates its cultural roots and consistency throughout its variety of topics and approaches while providing the Politecnico's large design community updated research avenues. The increasing amount of addressed themes tends to strengthen the bond with Italy's typical features, its local identity, mode of production, and the enhancement of our cultural and environmental heritage (Maffei and Bertola, 2008). Meanwhile, enlargement of topics demonstrated design's heterogeneous and multidisciplinary nature.

Over the last 30 years, the design discipline moved from a product emphasis to a broader user and community focus, to looking at wider perspectives that treat users, stakeholders, artefacts, and environments as part of interconnected systems (Rampino, 2008). This process of zooming out and becoming more inclusive is essential when society is seen as a systemic component.

### **The Milano Design PhD Festival: a public celebration of knowledge**

Ideals of openness and inclusivity, which are rooted in the design disciplines are the foundation of the main annual event in the PhD in Design's calendar. Aimed at promoting participation and offering to the large Politecnico design community an “in house” occasion to gain knowledge and nurture debate, eight years ago defending a thesis became a public event – the Milano Design PhD Festival – that is now at its tenth edition.

The discussion partly moved from the traditional “defence” into a “public celebration of knowledge” (Guerrini and Volontè, 2018, p. 9). The main

point was the event's openness towards the reference community, not just for academics, but practitioners, hybrid figures, and stakeholders.

Since its birth, the Festival's aim was to establish spaces and times to spread design culture, stimulate dialogue on its advances, and nurture networking. This last point is boosted by inviting guest international scholars, who are asked, not only to take part in discussion with the candidate but give lectures and participate in panels. By looking at the Festival in its entirety and variety of events we can say it provides an international, extended perspective on design matters, using an original formula. Each year, we are aware of how this formula is a distinctive feature of our PhD in Design, that emphasises the community's desire to grow and share its practices.

The Festival's social dimension becomes even more evident after sunset, when the food and drinks arrive, transforming it into an event that promotes informal conversations on design and design research. At its core is the intent to address a long-standing weakness of the design discipline (Buchanan, 1992) – the difficulty in starting constructive discussions and practical knowledge exchanges between practitioners and researchers, and different design academic communities.

The Milano Design PhD Festival's overall aim is to leverage diversity, interconnections, and reflect on the broad nature of design research. It has become an occasion where advances in design research become known, a chance to meet top international scholars and promote collective learning.

## **The PhD in Design Network: Feeding debate and growth**

The Festival has a twofold intent. The first is spreading local design knowledge by opening the event to different stakeholders, and the second is targeting a growing internationalisation which helps the circulation of people, ideas and research practices. We acknowledge the importance of taking part in the international debate about the nature (structure and learning approaches) of Design PhD Programmes, to provide a fundamental source of continuous improvement.

Seconding our willingness to discuss our research practices with other doctorates that have a long-lasting tradition, in 2018 the PhD in Design played a key role in building a PhD in Design Network with five renowned design schools – TU Delft, Aalto University, IIT Chicago, Carnegie Mellon and London Imperial College. Since its beginning, the Network organised bi-annual meetings among PhD Programmes which shared experiences, reflections and PhD level design education ideas.

To celebrate 30 years of PhD in Design, in 2020, Politecnico di Milano is hosting the network meeting as an official event featured by the Design PhD Festival.

## **Topics, interests, and directions across multiple research fields**

As part of a series launched in 2017, this book presents an overview of the doctoral theses to be defended in February 2020. Every year, it offers an overview of the richness of addressed topics, showing the variety of fields and the multiple aspects of design research carried out at the Politecnico di Milano, Department of Design. Such a variety, ranging from art history to mechanical and chemical engineering, across architecture and sociology, is attested by the many PhD candidates and supervisors disciplinary backgrounds and expertise.<sup>1</sup>

As said, our PhD looks at disciplinary diversity as a remarkable source of richness. We are in a time that recognises the value of research competencies which can explore emerging topics positioned at the intersection of multiple research fields. PhD Programmes promptly responded to this call to renew design expertise, looking at progressive hybridisation with neighbouring disciplines.

The relevance of this disciplinary blend to our Polimi community is shown to a larger extent by the Design Department's research directions. These directions aim at the areas where design overlaps with the other polytechnic disciplines: engineering (as expected), managerial studies, social sciences, arts and humanities. These overlaps define four interdisciplinary research lines, on which the Department has been focusing in the last few years, and will focus in the near future:

- Design for Advanced Manufacturing
- Design for New Business and Entrepreneurship
- Design for Social and Public Sector Innovation
- Design for Cultural and Creative Industries.

Taking advantage of the technological possibilities, and being aware of their implications, the explorations carried out by our doctoral candidates are changing the traditional areas that were once the established main domains

<sup>1</sup> For the thesis defended in previous years, see: Biamonti and Guerrini, 2017; Biamonti, Guerrini and Mariani, 2018; Rampino and Mariani, 2019.

of design interest. An inherently distinctive disciplinary trait has emerged: the need to consider and address complex societal and cultural issues, i.e. wicked problems. It is such a need that drives the evolving boundaries of design research, not just in our Doctoral Programme, but also other national and international Doctoral Design Programmes.

## **10 PhD theses**

The 10 PhD theses presented here were started in 2016 and cover the above mentioned four interdisciplinary research lines, sometimes overlapping them. They share a common trait in that they explore the implications of the ongoing digital transformations, from the specific perspective of design research. We are in a time of significant change, led by sequential digital revolutions. Such changes that are impacting our daily life, are not just technological, but also social and cultural. As a consequence, trends that are transversal to different fields are advancing, requiring design to be aware, responsive and, above all, predictive.

Acknowledging the potentialities of IoT, Artificial Intelligence, Additive Manufacturing and Automation, in recent years design has paid increasing attention to the impacts and opportunities related to digital technology. This has naturally slipped into our studies and helped orient them. Throughout the book, the cultural, organisational and social issues raised by digital technology and its applications, are debated, showing how such problems have become the subject of extensive research, analysis and experimentation.

We decided to organise the book into three thematic clusters: “Human-centered design practice,” “Digital transformation,” and “Ethics and social awareness”. The first two clusters address, from different perspectives, how and to what extent the ongoing digital transformation demand reframing of design processes, practices and models. The third cluster taps into a growing but still underexplored issue – the ethics and social awareness which have developed in today’s smart and interconnected world.

Each of the three clusters are introduced as follows.

### ***Human-centered Design Practice***

Recognizing culture and creativity as assets for competitiveness form one side, sustainable and inclusive growth from the other, this section addresses design for different expressions of cultural enhancement, opening critical

reflections on the role of design in defining approaches and tools for applied research (Battarbee and Koskinen, 2005). By adopting a service design approach, the three featured contributions demonstrate the capacity of design to develop frameworks and tools for complex design process management (Verganti, 2008). These processes involve the participation of players from different cultures, where end-users have an active role as co-designers and co-producers (Manzini, 2016). This resulted in updated models of sustainable and inclusive user involvement.

In the first chapter, Martina Rossi introduces her research on collaborative practices that make use of design tools and methods within private organisations. Emphasising how the design process influences and is influenced by the way people interact, behave and learn, Rossi suggests a framework for a dedicated course of action that can be adopted by private organisations making their first steps towards a collaborative culture.

In the second chapter, Milica Pavlovic addresses the topic of user interaction and experience design by discussing potential design strategies and toolset to be applied in the design of spaces enhanced by digitised services. Dealing with projects of high complexity, the study aims at expanding the current UX practice by providing a toolset as a backbone for structured design processes and creating a common language between the involved stakeholders.

In the last chapter of this section, Shushu He tackles the implications of today's multicultural society, where foreign people offer services to locals. Acknowledging that such services can be stereotyped or rejected because of established cultural biases, her study aims at helping UX designers to gain a deeper comprehension of values in cultural diversity so to enhance cross-cultural experiences.

## ***Digital Transformation***

The ever-increasing calculation power of computers makes other digital technologies possible and more powerful too. Digital technologies allow the collection and analysis of a vast amount of data, which processing was unimaginable by the human mind. At the turn of the new millennium, multitudes of people were empowered by Internet-access which could produce and share their own knowledge (Rampino, 2018). According to Brand and Rocchi (2011), one of the most profound social shifts is that now ordinary people can access social dialogue and exchange opinions across geographical boundaries. This is the result of two digital revolutions:

[...] over the last half century, two digital revolutions have come to pass, more spectacularly than Moore himself predicted. The first digital revolution was in communication, taking us from analog phones to the Internet. The second digital revolution was in computation, bringing us personal computers and smartphones. Together they have fundamentally changed the world. (Gershenfeld, Gershenfeld and Cutcher-Gershenfeld, 2017, pp. 3-4)

A third, more recent, digital revolution is on its way too. It is still in its early stages, but its impact on product design is already significant – digital fabrication. Consequently, new scenarios emerge, such as those of open and distributed manufacturing, experimented by Fab Labs and Makerspaces, and advanced experimentations in traditional sectors, such as Med-Tech and Fashion-Tech. When it comes to interconnected artefacts, the growing availability of embedded digital technologies, e.g. sensors, actuators, and processors, brings profound consequences (Schmidt and Van Laerhoven, 2001; Vermesan and Friess, 2013). Products and systems became dynamic and interactive, aware of their surroundings, with a form and a behaviour that can change in time. Moreover, the application fields have significantly enlarged and diversified, benefitting of integrating a technology that is today cheaper and increasingly diffused (Evans, 2011, 2012). This section outlines how different fields can sharply embed and take advantage of digital transformation.

In the section's first chapter, Carmen Bruno looks at creativity 4.0 and explores the influences of the digital transition on human creative potential. Bruno discusses the cognitive, emotional, motivational and social factors of creativity involved in the design process and outlines a framework that supports digitally enhanced human-centred design methods for innovation.

Arianna Bionda looks at Yacht Design in the second chapter. In an area where Industry 4.0, Internet of Things (IoT) and intelligent products are profoundly transforming design processes and outputs, Bionda presents a systematic and comprehensive study of future alternatives showing how digital technology could be implemented in a Yacht Industry 4.0 scenario, modifying yacht design approaches.

Digitisation of cultural archives and museums opened the way for extensive collections released under open licenses which fostered the creation of cultural content aggregators. Although such aggregators adopt performative technologies and rigorous sharing methods, their user interfaces still present usability issues that keep digitised heritage often invisible to the end-user. In the third chapter, Giovanni Profeta investigates classification systems and interface solutions that may foster the access and use of digitised cultural objects.

Along the same lines, Sara Conte suggests an updated drawing and representation system to enhance the preservation and fruition of modern architecture in the archival sector. She experiments the use of infographic BIM-oriented software and parametric models to preserve and communicate historical architectural documents. In particular, Conte addresses how digitalisation encompasses architectural archive projects, and proposes the valorisation of the heritage of Adriano Olivetti and his company in the city of Ivrea, through the work of one of its most representative, but less well-known designer, Eduardo Vittoria.

### ***Ethics and social awareness***

The distribution of digital technologies entails as many opportunities as unforeseen issues that affect our society at different levels.

[...] we built breakthrough digital communication capabilities, but we failed to build in cultural norms, feedback loops, and algorithms that could have reinforced civil discourse. We created incredibly efficient new models of digital commerce, but have also introduced new threats to privacy and security. We value the advances made possible with digital automation, even as we struggle with the impacts of lost jobs due to technology. (Gershenfeld, Gershenfeld and Cutcher-Gershenfeld, 2017, p. 5)

Individually and socially, advances in technologies have always brought significant changes. These are not just economic, but cultural and personal behavioural changes. The unwanted effects of the digital revolution(s) such as compulsive surfing, are becoming coeval wicked problems (Buchanan, 1992; Rittel and Webber, 1974) that require attention and consideration.

The pervasive presence of devices gathering personal data is feeding a growing amount of digital solutions that use this data to tailor and improve their offered services. The collection, storing, exploitation and sharing of this data, however, raises several privacy and security concerns. In her chapter, Laura Varisco addresses this topic, presenting a method aimed at eliciting designers' awareness about the impact of the use of personal information. Ranging from the data implied and the data flow of the designed solution, Varisco encourages the designer to consider possible effects on four "layers": self-awareness, action performance, interpersonal relationships and social agency.

In the second chapter, Mario De Liguori investigates a vital issue of our time: obsolescence in digital products. Positioned in the Life Cycle Design

literature and addressing the human environmental footprint, the study investigates whether lasting emotions towards electronic objects can affect the psychological wellbeing of people. Recognising that the topic's implications range from circular economy strategies to business models, simultaneously dealing with the principles of emotionally durable design theory, the chapter synthesises data and results of an empirical study lead on a sample of about 1.300 young people, mostly belonging to the Z generation.

The last chapter deals with one of the largest, and most challenging industries, Fashion. The Fashion sector has been strongly impacted by the digital wave that pressured brands and retailers into innovation while becoming ethically conscious of their cost. This sector is one of the world's most polluting. Trinh Bui Mai and Alba Cappellieri focus on Accessory Design and tackle the topic of sustainability, by presenting tools aimed at supporting fashion designers towards a more environmentally and ethically sustainable design process.

The overall book, and these last three chapters, are a wake-up call for our own responsibility. While pushing design research forward, we need to address any issue with a constant ethical perspective. In today's complex world, we must keep creating and spreading knowledge, while enhancing openness towards other disciplines and different cultures, taking care of the local environment without overlooking our society.

The fundamental issues that move and nourish design research have been categorised by Sato (2000, p. 137) into two macro-areas towards which the scientific commitment of those who conduct design research is directed. There is a need to deepen "design act" theories and methodologies while increasing knowledge on "design subjects." Due to the constant hybridisation and advancements, these areas are continually expanding. Regardless of the attention that inevitably arises on the mechanical and systemic aspects of artifacts, our context reference educates and prompts us to design with the human element at the centre. An aspect that takes on an ever-increasing dimension, because of the growing technology inclusion in our daily lives.

That is to say that, especially today, designing in an era of digital, social, economic, cultural transformation comes with broad responsibility. Often the impacts of what has been designed is unclear, and that is the scope of our investigation. It is up to us. Reasoning the what-ifs and the implications of what we create is paramount and an intellectual foundation of the design discipline that thoroughly permeates our community, and the PhD in Design, in particular, reflects it throughout its production.

## Acknowledgements

We need to thank the book's contributors, who dedicated time and energy to write an essay about their theses, just a few months from their defence. None of this would have been possible without their work and desire to share their intellectual labour and scholarly insights. We sincerely appreciate the fact that they spared vital time to fulfil our requests, contributing to represent the variety and diversity of our PhD ongoing researches.

We thank Politecnico di Milano, Department of Design and everyone at the PhD in Design who provided us with valuable help and assistance. The studies described in the chapters are mirroring our community. We are aware of the role that such an exciting environment plays in reaching advances. We gratefully acknowledge the supervisors and co-supervisors of the newly Doctors in Design<sup>2</sup> who challenged them for the last three to four years, and inspired and shaped their research. Further acknowledgements are made to the PhD Board and committees which over the years made their assessments moments of prolific debate on cutting-edge topics addressed by each candidate.

A special thanks go to Simona Murina and Paola Mosca, for being consistently supportive, as key members of the PhD staff.

We would like to thank the scholars who carved out space for us, and peer-reviewed ten essays in this book: Alberto Bassi, Andrea Vian, Giuseppe di Bucchianico, Ingrid Paoletti, Irina Suteu, Judith Ackermann, Lorenzo Imbesi, Marian Dörk, Massimiliano Ciammaichella, and Patrizia Marti.

In conclusion, we are deeply thankful to our PhD in Design Coordinator, Paola Bertola, for entrusting us with the responsibility of collecting and give back an overview of what is happening in our Programme for the second year running.

This book is truly a team effort.

## References

- Battarbee, K., and Koskinen, I. (2005). Co-experience: User experience as interaction. *CoDesign*, 1(1), 5–18.
- Biamonti, A., and Guerrini, L. (Eds.). (2017). *Polimi Design PhD\_017: 10 PhD thesis on Design as we do in POLIMI*. Milano, Italy: FrancoAngeli.

<sup>2</sup> The estimated publishing time is just a few days before the Milano Design PhD Festival, and the defence required for the authors' PhDs.

- Biamonti, A., Guerrini, L., and Mariani, I. (Eds.). (2018). *Polimi Design PhD\_018: 9 PhD theses on Design as we do in POLIMI*. Milano, Italy: FrancoAngeli.
- Brand, R., and Rocchi, S. (2011). *Rethinking value in a changing landscape. A model for strategic reflection and business transformation*. Eindhoven, the Netherlands: Philips Design.
- Buchanan, R. (1992). Wicked problems in design thinking. *Design Issues*, 5–21.
- Evans, D. (2011). The internet of things: How the next evolution of the internet is changing everything. *Cisco Internet Business Solutions Group (IBSG)*, 1–11.
- Evans, D. (2012). The internet of everything: How more relevant and valuable connections will change the world. *Cisco Internet Business Solutions Group (IBSG), 2012*, 1–9.
- Gershenfeld, N., Gershenfeld, A., and Cutcher-Gershenfeld, J. (2017). *Designing reality: How to survive and thrive in the third digital revolution*. New York, NY: Basic Books.
- Guerrini, L., and Volontè, P. (Eds.). (2018). *Dialogues on Design: Notes on Doctoral Research in Design 2018*. Milano, Italy: FrancoAngeli.
- Maffei, S., and Bertola, P. (2008). *Design, Research, Maps. Prospettive della ricerca universitaria in design in Italia. 2003-2007*. Milano, Italy: POLI.design.
- Manzini, E. (2016). Design culture and dialogic design. *Design Issues*, 32(1), 52–59.
- Pizzocaro, S. (2003). Re-orienting Ph. D. education in industrial design: Some issues arising from the experience of a Ph. D. programme revision. *Art, Design & Communication in Higher Education*, 1(3), 173–182.
- Rampino, L. (2018). *Evolving Perspectives in Product Design: From Mass Production to Social Awareness*. Milano, Italy: FrancoAngeli.
- Rampino, L., and Mariani, I. (Eds.). (2019). *Advancements in Design Research. 11 PhD Theses on Design as we do in Polimi*. Milano, Italy: FrancoAngeli.
- Rittel, H., and Webber, M. (1974). Wicked problems. *Man-Made Futures*, 26(1), 272–280.
- Sato, K. (2000). Constructing Knowledge of Design, part 1: Understanding concepts in design research. *Proceedings of the Conference on Doctoral Education in Design, France*. Presented at the Stoke-on-Trent, UK. Stoke-on-Trent, UK: Staffordshire University Press.
- Schmidt, A., and Van Laerhoven, K. (2001). How to build smart appliances? *IEEE Personal Communications*, 8(4), 66–71.
- Verganti, R. (2008). Design, meanings, and radical innovation: A metamodel and a research agenda. *Journal of Product Innovation Management*, 25(5), 436–456.
- Vermesan, O., and Friess, P. (2013). *Internet of things: Converging technologies for smart environments and integrated ecosystems*. Delft, Netherlands: River publishers.