



Chair:  
**Prof. Francesco Trabucco**

## DOCTORAL PROGRAM IN DESIGN

### Field of study

Held at Politecnico di Milano university, the Doctorate in Design Research is created and managed by Design Department, in cooperation with the Department of Mechanics and the Department of Chemistry, Materials and Chemical Engineering. Politecnico di Milano research doctorate courses aim to build the skills needed to perform highly qualified research jobs in manufacturing and service enterprises, the public sector, and the university. The scientific field to which this course belongs is industrial design. Its interdisciplinary relationships include the philosophy and theory of language, art history, design, science of materials and technology, industrial engineering, decision making, and computer science.

Industrial design, following the meaning adopted within this doctorate, is intended as a discipline acting within the industrial culture and accompanying its transformations. Among its main tasks is to deal with processes and products configuration. In this sense, this school specific meaning goes to use, function, social and individual consumption of the products (the functional, symbolical and cultural factors) as to manufacturing (techno-economical, techno-systemically, techno-productive and techno-distributive factors). All these themes are expected to be faced with the support of the conceptual tools of research in its theoretical, critical, historical and methodological articulations.

The complex of the issues investing the theme of innovation will represent the conceptual trajectory of the whole program. The attention to innovation-related phenomena are due to various factors, partly internal to the dynamics of the discipline of industrial design, partly motivated by the perception of the growing complexity of the innovative process, thus fostering in-depth analysis and new approaches which can legitimately be faced within the doctoral programme. Whatever the motivations for the analysis of technological change and innovation, this trajectory of enquiry highlights the factors and fundamental ingredients of the process of development, transition and transformation of industrial products, services and systems. As a starting point a broad view of innovation is assumed, being a dynamic process involving the development or improvement of new products, services, technologies, processes, institutions, systems, strategies. Such an extended view of innovation includes the range of economic and social activities

- in areas such as communications, corporate strategies, market dynamics, education, public institutions - so relevant for design action as product design in its strict sense.

### Professional qualifications

The Doctorate in Design aims to train a designer/ researcher with malleable qualifications. For the professionals produced by this programme are both designers who know how to do research and researchers skilled in using design tools. At the same time they are experts in managing awareness, in constructive interaction among various players, and in the communication of

ideas and concrete proposals.

This skill set finds application in a variety of work environments. It is particularly in demand in organizations explicitly devoted to developing design research, such as universities and research centres, design agencies, and companies that are attuned to social and technological innovation. It is also sought out by public-sector organizations, by service enterprises, and by local development organizations, which are increasingly faced with complex planning problems that the designer/ researcher can effectively deal with, analyze, and find solutions for.

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## INDUSTRIOUS DESIGN. THE ROLE OF DESIGN IN THE EVOLUTION OF (MICRO)PRODUCTION MODELS ENABLED BY THE HYBRIDIZATION OF INDIVIDUALS AND ORGANIZATIONS

Massimo Bianchini - Supervisor: Prof. Stefano Maffei

This research explores the change in production models from the design perspective. It is an emerging socio-technical paradigm characterized by new forms of advanced, open and distributed manufacturing. Democratization of fabrication devices linked to an increasing abundance of low cost (free) design resources, the appearance of *indie* online marketplaces and new social forms of micro-financing innovative projects (*crowdfunding*) represent a set of new opportunities to develop independent and integrated small and micro scale production activities 'from idea to market', directly.

Production phenomena such as *making* and *personal fabrication* related to some physical and virtual places as Fab Labs and other platforms for digital manufacturing and the open design certainly represent a technology-based evolution of the traditional world of self-production or DIY.

Nowadays, a heterogeneous set of productions developed by individuals or groups, without being designers or companies, can materialize their ideas independently, transforming them into product-service solutions, even technologically complex, potentially marketable on a global scale.

A small population of

individuals, who are not designers or manufacturing companies, can materialize their ideas independently transforming them into product-service solutions, even technologically complex, and potentially marketable on a global scale.

In a scenario as that described, where the innovation processes appear driven by new players such as makers, two questions are emerging: What's the (new) role of design? how do designers change their skills and capabilities?

The research starts from this assumption: the new forms of production without a defined *design intent* and without the support of adequate design skills seem to be not (so) generative. The proliferation of object-gadgets on personal fabrication web platforms is a clear example.

On the other hand, the low quality of many artefacts materialized in the Fab Labs demonstrates how new manufacturing technologies, while expressing great potential, are not yet able to replace industry and craftsmen (and it is not clear whether will never be able to do so). Instead, there seems to be an interesting field of action for individuals who are able to hybridize (in an original way) design and fabrication skills in order to materialize new

artefacts through innovative manufacturing processes based on alternative technical and technological configurations of the production meanings (intendevi dire 'significato?'). And the designers are among them.

On this basis, the research proposes a systematic study about the change of production models, especially those on small and very small scale. The first part of the study describes the set of features and possibilities of evolution of technologies for advanced manufacturing and distribution. This study contextualizes the new models of production compared to the historical ones, from Taylorism to flexible specialization (lean manufacturing). This exploration continues studying the characteristics of the new places that enable new forms of production - from Fab Labs to makerspaces, from TechShops to DIYBioLabs - and mapping new types of producers as makers, who are the interpreters. These places and subjects are then observed within specific contexts such as the city, identifying a variety of forms of production which interact with each others, suggesting the existence of a system called '**distributed microproduction**'.

The second part of the research focuses on the change of designer skill and capabilities

in relation to the change of production models, in particular distributed microproduction. Research has noted that standardization of design professions together with outsourcing and deindustrialization processes are changing (in worse) the traditional relationship between designers and manufacturers. At the same time new opportunities offered by digitization of production are gradually pushing parts of designers population to transform their own nature. These designers (for necessity and/or personal interests) become new producers and summarize in a personal dimension all the functions of a manufacturing company: research and development, design, prototyping, production, promotion, distribution and searching funds. They also prototype and produce microproduction processes when design activity is expressed not only focused on artefacts, but also on the configuration of the resources used to produce them: from materials to tools and machines, to the places of production as the *microfactories*. Research has defined these subjects through the conceptual model of '**designer=enterprise**', drawing an initial taxonomy of microproduction processes, design approaches, and related

business models.

The third part of the research analyses and verifies the activity of designers=enterprises both internationally and in a national context (Italy). More than 100 projects developed by designers-microproducers have been observed, also arranging interviews and visits to several design studios.

An online survey conducted on over 100 Italian makers, designer-producers and makerspace managers has studied in details the microproduction processes. Basic data and information about economic condition of designer=enterprises, production skills and distribution strategies have been obtained to understand the economic sustainability of these activities and their prospects of development.

## PROCEDURAL DESIGN AND ORDERED COMPLEXITY.

### Code, pattern and digital fabrication

**Giorgio Buratti** - Supervisor: **Prof. Michela Rossi**

In the planning process design has always preceded the construction phase. The act of designing is an opportunity to organise one's ideas, manage resources and predict results, and is made possible through the use of dedicated instruments. The introduction of the computer as a design tool has been epoch-making. Modelling programmes gradually began to have a greater influence on the design process. Over the years the level of involvement of software grew, developing from a representational role to having a direct influence on the process of generating forms, sometime even characterising the structure of the artifacts.

In recent years, economical, social and cultural changes have accelerated the advent of a digital and globalised society. In a world in which hardware devices are omnipresent and constantly interconnected, software and the ability to manage it becomes key. Smartphones, tablets and other electronic devices are increasingly becoming terminals rather than independent objects, so much so that they cannot be used if they aren't connected to the information infrastructure. Hardware is becoming less relevant, to the point that it is possible to significantly alter its performance and

behaviour simply by replacing the operating system. The material system is subordinate to the definition of the code and language that enables it to function.

In the case of design, the increased levels of computer literacy have led designers to analyse the processes that underlie the functioning of the digital instruments used on a daily basis. This interest has given rise to a new type of modelling, based on the elaborative logic of information, which has determined a new phase in computer assisted design, in which the form is generated by drawing up algorithms.

An algorithm is a systematic procedure based on a series of unambiguous instructions that explain how to achieve a specific objective. Used in design it promotes research based on the importance of the code-procedure concept: if the solution to a problem can be described in a finite number of steps, in the same way the identity of a form is the consequence of a series of discreet rules that define it. The form is not defined a priori but stems from a process of the refinement of conceptual, communicative, structural and geometric instances that lead to the result most in keeping with the initial expectations.

The possibility of designing structured geometries would clearly be pointless if they couldn't then be created. In parallel to the development of software, or perhaps because of it, there has been a convergence towards the digitalisation of production processes thanks to machines able to construct, either in whole or in part, the designed object, starting with its digital model. This process is known as Digital Fabrication and does not require additional interpretations to that of the designer as the file is prepared in real scale and fabricated without the involvement of intermediaries.

As is often the case when a new technology is first adopted, the exponential dissemination of the tool in the professional sphere does not correspond with adequate theoretical development that can integrate the theory of the design with the potential on offer. The excitement over the new possibilities offered by the new applications has seen a move from conceptualisation to mere jargon. With computer assisted design accompanying the designer from the generation of the form through to its digital fabrication, the integration with theoretical analysis and comprehension tools able to maintain a high level of design coherence is increasingly necessary.

The aim of the thesis is to explain the influence of generative modelling software on design and fabrication theory and practice. More specifically, the aim is to understand to what degree, and according to what logic, these tools can also be configured as conceptual devices able to define correct methodological procedures for assisted design.

As such, what is proposed is a methodological approach, until now barely developed, that integrates computational methods in the design process. With this in mind, the research analyses on one hand the relationship between geometry and the digital tool and, on the other, how it is possible to use abstraction for design purposes through a single systemic process able to manage the increased level of complexity admitted by new approach. The term "complex" does not simply mean "complicated"; rather, it is a precise definition that refers to the science of complexity, a field of research that has not yet been completely formalised but which is equipped with theoretical tools suitable for the new context. In the systemic vision the units are relationship patterns, inserted within a broader network of connections. In Design, for example, form may be considered the result of the interaction of precise formalisable and quantifiable conditions (formal aspect, materials, physical and temporal constraints, pre-established goal, interaction with the user, economic and production factors) and a creative instance that must be implemented. These determining factors interact reciprocally to achieve a

common goal and so the design process has all of the typical characteristics of a complex system.

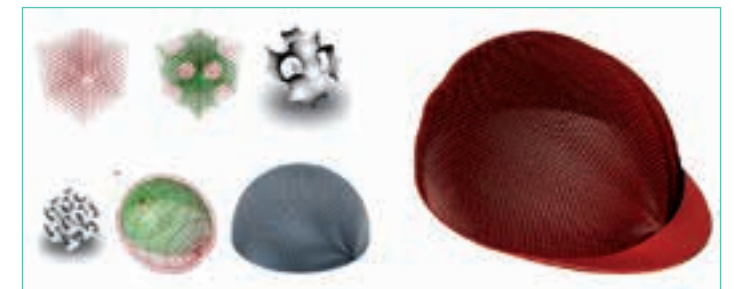
Considering the design process according to systems theories does not just mean breaking down the design into its various component levels but understanding the relations created between these levels so that they can be balanced. The revolution inherent in the new digital tools is the way they have transformed the discipline of design from iconic representation to the representation of relations and processes. In this new dimension the various design instances can be organised in emerging relational structures that transfer typical characteristics of living systems to the design process, such as the ability to adapt and transform, and self-organisation. This behaviour cannot be controlled according to the classic linear method (top-down), which seeks to predict all possible situations and subsequently prescribes the solution for dealing with them. Only by defining the behaviour of entities on the basis of the design (bottom-up) and leaving the task of simulating the collective effect of the

interactions to the calculating power of the computer is it possible to check the validity of the design hypothesis.

Starting from the study of the different denominations used today to define the paradigm this thesis proposes *Procedural Design* as definition to clearly identifies the character of the new approach.

To the theoretical model follows the analysis of the technologies typical of digital fabrication. As well as verifying new production possibilities, this study also seeks to understand the organisational methods required for the management of these and the possible consequences on the socio-economic context and the role of the designer.

Finally are presented the experiments carried out during the PhD, the comparison of which highlights the potential of procedural programming, opening the way to additional experimentation and research.



1. Procedural-Algorithmic design: a single complex geometry minimal surface (a Gyroid minimal surface) is placed in a periodic system. Subsequently the porous structure is used to create a protective helmet

## GRANTS FROM BANKING FOUNDATIONS AND TRUSTS. A MODEL OF DESIGN FOR THE PRESERVATION AND DEVELOPMENT OF LIBRARIES, ARCHIVES AND MUSEUMS

**Nadia Campadelli** - Supervisor: **Prof. Pietro Cesare Marani**

This study attempts to trace the role of banks, banking foundations and trusts in the territory of cultural heritage; in particular referring to a design able to manage the activities of museums, libraries and archives. This research analyses the works of trusts and banking foundations, exploring the underlying motivation for their intervention in public utility as well as in private and public projects relating to cultural institutions and arts.

The research chooses four case studies in order to investigate their historical background and understand the development of different systems adopted by banks and trusts. A literature review has been conducted to answer the central research question: What is the best design in the long-term funding of cultural institutions?

I have identified a workable model in the sustainable advanced design for cultural organizations able to communicate with private actors such as donors, sponsors, and trusts. Data and interviews have been analysed to test the possibility of applying this design network model to museums, archives, and libraries. Further investigation was conducted at a regional level on the existing networks among cultural institutions to ensure the application and originality of this

design platform.

To conclude, this research addresses the importance of strategic design in shaping the actions of foundations and trusts to the development of cultural institutions.

I propose a sustainable advanced design model that could be replicated by different organizations through this research.



# TRANSMEDIA DESIGN FRAMEWORK

## A Design-Oriented Approach to Transmedia Practice

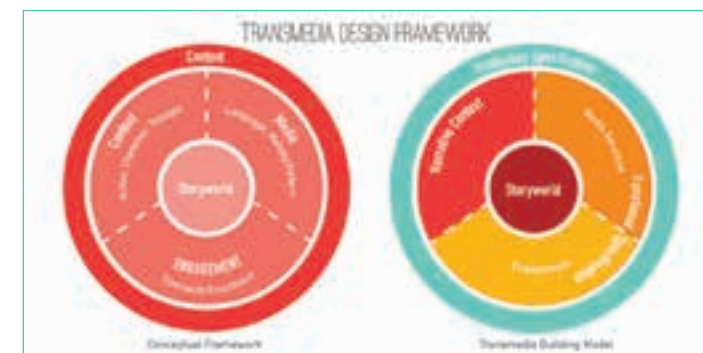
**Mariana Ciancia** - Supervisor: **Prof. Maria Luisa Galbiati**

Due to the rising number of multi-modal devices and the higher number of messages being conveyed across several channels, designers now have a key role as mediators. Indeed, they must bring different social contexts together in mutual understanding. In a *mediascape* designers play a dual role; as story listeners they collect stories from audience and repertoires and as storytellers they organise these stories into experiences. Beginning with these assumptions (and in accordance with theories and projects developed over a number of years), this research aims to determine a new form of literacy that allows communication projects to be developed that rethink the participatory process and merge different languages, media, technologies. The evolution of social interconnections through digital technologies has emerged from a phenomenological approach to contemporary mediascape. Such that, multi-channel structures have become increasingly important and completely changed the role of the audience, this in turn has allowed for the development of widespread creativity through collaborative creation and the collective consumption of narrative worlds. With a focus on the domains of media studies and design

research, the core topic of this research is multi-channelled structures. These structures are able to foster the sharing of meaning-making processes between producers and audiences and shape society and influence media habits through storytelling, story listening and engagement. The research also focuses on transmedia, a phenomenon concerned with the building of a story universe through different channels to enhance the role of the audience. It is a socially understandable paradigm, the growth of which requires special skills and teamwork. It is hypothesised that transmedia practice is a procedure that could address the issue of contemporary complexity through a phenomenological approach to the coeval reality. A cultural paradigm was focused on to allow people to become aware of the prominent role played in the contemporary mediascape and emphasis was also placed on the storyteller's ability to support multiple points-of-view. Transmedia is a phenomenon that allows audiences to participate in the meaning-making process and changes the relationship between the mainstream media and participatory culture. Thus, this work starts from the assumption that, because

of story-building processes capable of fostering audience engagement, activating collaboration among peers and social innovation, transmedia can sustain local communities in the development of on-line and off-line interactions. Transmedia can be described as a practice made up of tacit knowledge that people work with in an intuitive manner and that follows a '*learning by doing*' approach (which hails from a Renaissance studio model recovered from the design field). A literature review revealed that there is a lack of sharing practices in transmedia project development. Thus, it is clearly necessary to identify interpretative models and guidelines for its design. This research aims to identify the main features of transmedia projects to build a glossary that can be shared and that will contribute to the development of a useful tool for transmedia practices. Such an instrument could become a conceptual and operational tool for the designing story world, not only for big Hollywood productions, but also for everyday scenarios. Based on a necessity to understand how aesthetic and economic issues work together within the design of complex story world, a conceptual and operational tool (*Transmedia Design Framework*) was

developed that combines two layers: *Conceptual Framework* and *Transmedia Building Model*. The former, *Conceptual Framework*, aims to sustain the comprehension of complex phenomena. It intertwines the key features of transmedia projects together with the six elements of Aristotle's poetics. These qualitative elements structure a drama like an 'organic whole' and were translated for the *Human Computer Interaction* by Brenda Laurel in *Computers as Theatre* (1991) as: *action, character, thought, language, melody (pattern) and spectacle (enactment)*. This research in turn defines the five concepts of the conceptual framework as: *story world, content, media, engagement and context*. The latter, *Transmedia Building Model*, suggests guidelines, tools and an on-line platform for the development of a transmedia project within multidisciplinary teams. Specifically, a model constituted of four main sections for the activation of an iterative design process, each of which requires specific skills. The four sections are: *story world, narrative context, functional specification and production specification*. The building and the validation of the *Transmedia Design Framework* intertwined the experimentation of transmedia



1. Conceptual and operational tool (Transmedia Design Framework) that combines two layers: Conceptual Framework and Transmedia Building Model.

practice at a local level within the *Plug Social TV* project ([www.facebook.com/plugsocialtv](http://www.facebook.com/plugsocialtv)), which was activated in a peripheral urban area in Milan (specifically, in the Bovisa and Dergano districts). Since 2013, final year students of the Masters of Communication Design programme (School of Design, Politecnico di Milano) were guided by my research group (*ImagisLab*) in the management of web-based television and in the design of transmedia television content. This experience was essential to fully understand the underlying processes in the development of multi-channel projects. Indeed, observing, monitoring and revising the students' work was fundamental to the development and exploration of insights and hypotheses about the construction of the *Transmedia Design Framework*. In light of the feedback obtained from students, this conceptual and operational tool is in the process of being refined, not only for those who already have experience in designing transmedia experiences, but also for those who are new to the field.

*Plug Social TV* is web television that makes use of social media to produce content that aims to test and verify the ability of stories of local interest to activate self-representation and self-narration and fosters a dialogue in a neighbourhood among its different inhabitants. In fact, in these Milan districts dual personalities exist. Formerly industrial areas, these districts are now populated by a mix of older workers, artisans, foreign citizens, and engineering, architecture and design students attending at Politecnico di Milano. Approximately one hundred students and thirty members of the local community have tested *Plug Social TV* and the potential of transmedia systems in a specific local area, outside the entertainment market and mainstream productions.

## DESIGN OF ILLUSORY SPACE. QUADRATURA AS PERSPECTIVE-BASED DESIGN.

**Laura Galloni** - Relatore: **Prof. Giuseppe Amoruso**

The design of illusory space is a research topic that lends itself to some reflections, as well as from the practical point of view, also from a theoretical one. The research highlights and represents the principles of projective-geometric design of illusory spaces and proposes a detailed study about the architectural perspective called "quadratura", which featured the applications of science and art to interior decoration and architectural spaces during the sixteenth and the seventeenth century. The fundamental content of each quadratura is the three-dimensional ideation space and the extension of architectural surfaces, a veritable figurative palimpsest. The aim of the PhD research is to promote a deeper understanding of the quadratura as a tool for the design of the illusory space. Studying the case studies, verifying how the use of perspective has been the key to correct the space, it is believed that this instrument can be reused and have a relapse in the contemporary design. The quadratura, in the contemporary practice, can be a support to design a place or enrich an existing space, an interior setting or a public environment. Perspective is a still useful tool in the design of exhibitions or in scenography. Relationships between perspective and its

design expressions are the most practical and applicable templates for the illusory space design. The thesis is a research of design representation in the interior design framework and this study aims to pinpoint as architects and artists of perspective worked, disclosing the project contents that are related to quadratura and the description of the different functions of the perspective, building the space also as a place of experience and expression of the ways of thinking, a process that allow the built environment's transformation. The thesis has analysed the concept of a selection of figurative space, going to deepen the formation of the concepts of perception and illusion from antiquity to Renaissance, and to Baroque. During Renaissance was given emphasis to projective methods, of which were investigated the principles of geometric and optical ones in the proportions and in the visualization of architectural works, and the use of perspective as a projective system accelerator or slowing the effects of the natural perspective to modify certain environmental aspects, external and internal, to the built volumes. The study about perspective issues was therefore due to verify its evolution from

the medieval meaning bound by the laws of optics and light to that of graphical method for depicting spatial depth and introducing the concept of infinity. For this reason the use of perspective also to change and transform the space, therefore understanding it as a parametric tool for design of the space itself. Considering the cases where the built space becomes a set, ephemeral and therefore "illusory", perspective has been analysed as the design of the graphic form of perception. The second part of the research analyzes theory and technique of quadratura design, highlighting design methods and perspective applications, and studying the projective operations and techniques of perspective theorized by the numerous treatises of the sixteenth and seventeenth centuries in the many documents. It was considered appropriate to highlight the case studies in which the practice of perspective "seen from below upwards" was applied, ie the typological solutions for the decoration of vaults, ceilings and walls, and their specificity. The deepening of the manuals and treatises written and circulated in Italy, France and Spain, has highlighted the studies done on the project applications and the ways in

which the perspective transforms the space, highlighting the interest of prospective treatise to the system perspective and to the manner of execution of the construction of illusionary space. Precisely the relationship between the rule of perspective and the necessary practical realization constitutes the most exciting theoretical and practical universe for scientific investigations. It was therefore necessary to examine the projective principles underlying various works, to investigate which spatial forms were mostly adopted and, according to the typological design, pinpoints the perceptual and narrative issues that are the result of the vanishing point position choice. This research has proved particularly interesting points, since very often parallels and feedback have emerged among works and between what it has been found in written documents and what has actually been built. Jacopo Barozzi da Vignola, Sebastiano Serlio, Pietro Accolti, Jean du Breuil, Abraham Bosse, Giulio Troili, Andrea Pozzo, Ferdinando Galli Bibiena and Antonio Palomino are the selected authors because they are considered the most interesting according to research purposes. Dealing with a research project that identifies the quadratura parameters in relation to the use of perspective drawing and its material reproduction, from sketch-concept to perspective tools to achieve pouncing on flat surfaces and on vaults, we can scientifically determine methods from field practice and subsequently verify their reproducibility and variations,

and also the most appropriate operational and conceptual features. Re-read treatises and extract types of applications that can still have a design interest, is an important achievement for scholars and therefore the research has set out to highlight the relationship between tool and method in the construction of illusory space. The research has therefore initiated the classification of the techniques for the practice of quadratura, identifying the experimental methods then become consolidated and universal. The third chapter of the research analysed the spread of quadratura in Lombardy, also validating the projective and typological constants of paintings, comparing theoretical studies, manuscripts and treatises to the solutions of the Emilian school who first influenced the birth of quadratura in Milan and Lombardy. It was created a mapping of the artworks in the city of Milan, highlighting places in which "quadraturisti painters" operated. The research pointed its studies about two case studies, Palazzo Crivelli in via Pontaccio and Palazzo Litta in Corso Magenta, which host very significant and interesting quadratura decorations. Consider what are the tools and methods to create an illusory space is an issue currently taken into account where there is a need to create new architectural scenarios: the story of quadrature is the direct reference, and there arises the question whether it can still be reactivated. Having analyzed the theoretical evolutionary route, and with regard to case

studies, having noted the works with both digital technologies and traditional techniques, the methods and ways of working of authors and artists have emerged. Indeed, precisely in the face of this analysis, we can certainly support their reactivation and re-appropriation to a modern and contemporary use. The classification of techniques of quadratura have proved to be operations aimed at highlighting the design principles that still can guide the design process of the illusory space and where we can highlight its methodological value. The challenge is to make the role of the representation still useful and effective when is describing the design of an interior; this task is more attractive if we pinpoint knowledge and practical solutions in an era ruled by digital technology. The research concludes its dissertation showing how design representation can intervene, adding value, in the processes of concept development in the practice of interior design; representation and graphic approach consolidate their role, identity and value even through the study, documentation and transmission of such design methods.

## LIVING THE EVENT

### Temporary housing models for large events

**Laura Galluzzo** - Supervisor: **Luisa Collina**

The research investigates models of temporary accommodation and particularly temporary housing solutions at mega-events such as expos, Olympics, major concerts, fairs, and cultural, political and religious events, with particular attention paid not only to visitors' accommodation but also to the staff working for the organization of the event itself. The disciplines of reference for the study are mainly interior and service designs.

The thesis also explores the urban dimension and the response of the city to the growing demand for temporary accommodation linked not only to large but also to small and medium-size events. Specifically, the study is divided into two parts: the first is theoretical, offering the general frame of reference and an introduction to the theme of contemporary housing, with a special focus on temporary living spaces (as a main character of contemporary living). Within this we will find a classification of the different temporary housing typologies in order to then explain the dichotomy of home vs. house in the terms of occupation vs. adaptation. In other words we will look at the dialogue which is established between the necessities and needs of the inhabitants and the answers given by the space

itself, through adaptations and variations of the interiors, in order to welcome and foster the expression of the occupants' identity. In particular, within the "home as occupation" chapter, we will look at studies in environmental psychology to describe different strategies employed in order to feel at home and express one's identity even within temporary living spaces. In the "house as adaptation" chapter we will instead look at transformations and alterations of interior spaces in terms of design for "degrees of freedom", to quote Ugo La Pietra, that allow the occupants to express their identity. Finally, in the conclusion of the theoretical part, we will introduce the concept of "interior legacy" to describe what interior spaces leave with us after their use, in terms of materials and remnants, but also of memories.

In the second part we will look at the practical implications of the research, the description of the design for the temporary living spaces of the Expo Village made available to the delegations and the staff of the event, Expo 2015, in the city of Milan. The output of the research is also made up of a series of guidelines for a hospitality system connected to the context of events.

The methodology adopted relies

on one hand on the analysis of selected case studies, which include field observations (London 2012 Olympic Games) and the study of texts and data collections, while on the other hand it is based on the evaluation of interviews and questionnaires. The interviews were conducted with people who had participated in major events as staff and could share their opinions on the management of the hospitality sector in that specific context, while the questionnaires were filled out by those who will be taking part in the next expo (Milan 2015) as staff or delegates of the various participating countries. The views of beneficiaries and workers of the hospitality sector of a large-scale event will help to understand the expectations and desires of all users.

Another instrument of research was workshops through small forms of co-design, activities aimed at non-specialist audiences, the results of which may help to investigate the possible interpretations of the more general issue of temporary living and the characteristics of the interior spaces for the hospitality functions (for example, the workshop "Feel Like Home", held during the event "Meet Me Tonight: Researchers' Night").

As mentioned before, the

theme of the research is part of a broader context that includes temporary living, sociological, anthropological and environmental sociology researches on the relationship between the house and its inhabitants, but also the design of low cost hospitality and the role of events as an opportunity for the rebirth of the city, focusing on large events but also on small and medium-size ones.

# DESIGN WUNDERKAMMERN

## The contemporary practice of collecting design

Virginia Lucarelli - Supervisor: Prof. Maurizio Vogliazzo

Advisor: Prof. Giampiero Bosoni

The practice of collecting design can be considered as a new phenomenon. For the last two decades the demand for historical rare objects and for contemporary pieces that transcend the boundaries between design and art has steadily increased. People have been showing a new attitude towards design objects and as a consequence the design market and the industrial manufacturing system have been changing their patterns. The prices of the design works have started to rise, together with a new conceptual and narrative approach in the design processes. The global market for historical and contemporary limited-edition design pieces, small and elitist though it is, has developed as a consequence of significant changes in the practices of producing, selling and buying design works. Galleries started to present design in the same way of art, and because of that collectors began to purchase pieces manufactured by designers, as they were artworks. Auction houses started holding sales dedicated to historical and contemporary works by designers and architects. International and domestic fairs dedicated to collectible design have seen a significant increase in sales and attendance and a noticeable number of

industrial designers has shifted to craftsmanship because unique pieces are highly requested by the market. Along with a growing attention by collectors toward the realm of collectible design, what is happening today is a progressive overlapping of roles and responsibilities in the research and experimentation within the design field. The key players of both the primary and the secondary market are shifting from being only involved in the sale and exhibition of collectible design to becoming meaningful actors able to encourage appreciation and understanding of design culture. Through curated exhibitions, sales and online platforms they influence the development of the market and they address critical issues related to historical and contemporary design. Although an academic interest in the market of collectible design is still in its infancy, mostly because it is seen as a commercial phenomenon not worthy of being investigated from a theoretical perspective, this research study relies upon the main hypothesis that the cultural implications connected to the distribution and production of non-industrial design could truthfully enrich and develop the multifaceted culture of design. The phenomenon has indeed a strong commercial core, that is

not deniable, but its implications are also affecting the consumption and the perception of design in an extensive way. Whilst the art market has been widely studied by art business, both a professional and an academic discipline, there are no conventional markers for the market value of design pieces. The amount of literature dedicated to the development and the dynamics of the market for collectible design is still minimum. Most of the studies conducted on the topic highlighted the psychological, symbolic and poetic values of the objects, their meanings and the cross-fertilization between design and other disciplines. What remains to be explored, however, is how faithfully the market for collectible design has followed the art market's structure and what cultural implications this particular system may generate in the future of design culture. Nowadays it is not possible to make a distinction between the shift in public interest about design and the shift in the market for it. The research moved from the previous statements and developed on the basis of one main hypothesis: the limited edition design production, distribution and consumption can be considered a cultural phenomenon able to enrich the

contemporary culture of design. Starting from this hypothesis the research tried to answer the following questions:

1. Which are the cultural and narrative implications of limited-edition design in the contemporary design culture?
2. How to formalize the theoretical and practical framework in which the practice of collecting design takes place?
3. What kind of curatorial and marketing strategies do market players adopt in order to address cultural and historical perspectives about design?
4. How collectible Italian design is perceived and absorbed by the market?
5. What could be a general framework to facilitate the sharing of collectible pieces between private collectors and institutions?

The investigation and the analysis have been conducted with the main purpose of delineating the design market infrastructure as basis for understanding the collecting praxes and the new relationships that market players establish with collectors and designers, affecting the whole design scenario. The research study started from the world of design culture and design history and entered the domains of collecting practices, art business and museum studies, trying to frame the contemporary way of collecting design through the investigation of the features of limited-edition design production and the new role of design market players. Beside the purely economic aspect of the phenomenon, more efforts had to be made to formalize

the roles and responsibilities of market players, to determine what makes some of the pieces presented on the market more valuable than others and what makes them denoted as collectible. The theoretical framework built behind the research is composed of many disciplines and areas of interest. They transformed and affected each other's through direct and indirect relationships that allowed a comprehensive and integrated knowledge and understanding of the practice under analysis. On this ground the research study is no longer about design itself but about the dynamics and practices that the market for collectible design enables and how these discourses could involve museums and institutions with the purpose of enhancing and nurturing the design heritage. Adopting a multiple case studies methodology and a direct observation viewpoint, this research study intends to gain greater understanding of market players' strategies and to define the extended boundaries of the discipline outside the industrial's processes. The main aim is thus to underline how the market for collectible design distinguishes itself from the art market, of which he inherited timing and mechanisms, and how the market players helped to shape the theoretical framework behind the expanding practice of collecting design. Together with the investigation of critical issues related to the importance of sharing collections, the research presents the concept of a shared database that allows the mutual loan of collectible design pieces between private collectors, dealers and museums.

A specific scenario, the Triennale Design Museum in Milan, chose for its peculiar collections' management, allowed to set guidelines for the development of a general design framework. The final output of the research is a meta-project tool aimed at providing museums and cultural institutions with a new platform to identify and share historical and contemporary design pieces transiting the market. *Design Wunderkammern* could be considered as a facilitator of processes, discourses and relationships between design collectors, practitioners active in the market and cultural institutions. The developed interconnected scenario could indeed increase and nurture the non-industrial design heritage and could also affect the perception and understanding of the multifaceted contemporary design culture.



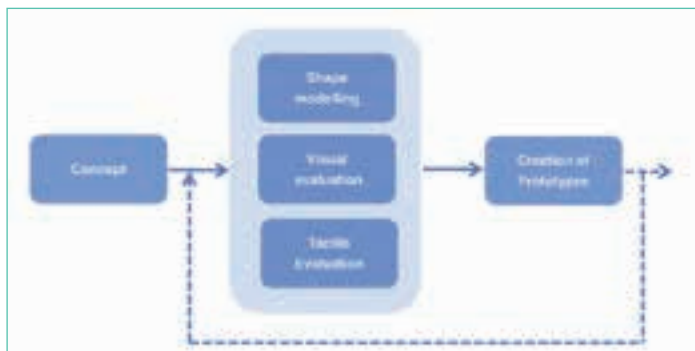
# TACTILE DISPLAY FOR VIRTUAL 3D SHAPE RENDERING

**Alessandro Mansutti** - Supervisor: **Prof. Monica Bordegoni**

The product design process is based on a sequence of phases where the concept of the shape of a product is typically represented through a digital 3D model of the shape, and often also by means of a corresponding physical prototype. The digital model allows designers to perform the visual evaluation of the shape, while the physical model is used to better evaluate the aesthetic characteristics of the product, i.e. its dimension and proportions, by touching and interacting with it. If the new shape, either in its digital or physical form, does not satisfy the designers, it has to be modified. A modification of the digital model requires a new physical prototyping of the shape for further evaluation. Conversely, a modification of the physical prototype requires the consequent update of the digital model, which can be performed by remodelling the shape, or using techniques as reverse engineering. Design and valuation activities are typical cyclical, repeated many times before reaching the optimal and desired shape. This reiteration leads to an increase of the development time and, consequently, of the overall product development cost. Indeed, it would be very efficient and effective if the two kinds of evaluations would be performed

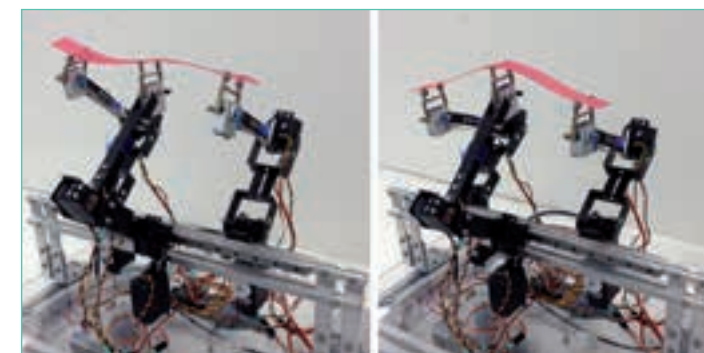
at the same time, instead of in two distinct moments and by using different means. Today computer-based tools do not allow us to perform the visual evaluation and the tactile evaluation at the same time. The aim of this research work is to develop a novel system for the simultaneous visual and tactile rendering of product shapes, thus allowing designers to both touch and see new product shapes already during the product conceptual development phase. The proposed system for visual and tactile shape rendering consists of a Tactile Display able to represent in the real environment the shape of a product, which can be explored naturally through free hand interaction. It allows designers to explore the rendered surface through a continuous touch of curves lying on the product shape. Ideally, the

designer selects curves on the shape surface, which can be considered as style features of the shape, and evaluate the aesthetic quality of these curves by manual exploration. In order to physically represent these selected curves, a flexible surface is modelled by means of servo-actuated modules controlling a physical deforming strip. The device is designed in order to be portable, low cost, modular and high performing in terms of types of shapes that can be represented. The developed Tactile Display can be effectively used if integrated with an Augmented Reality system, which allows rendering the visual shape on top of the tactile haptic strip. This allows a simultaneous representation of visual and tactile properties of a shape. The developed Tactile Display has been compared with similar devices, which are

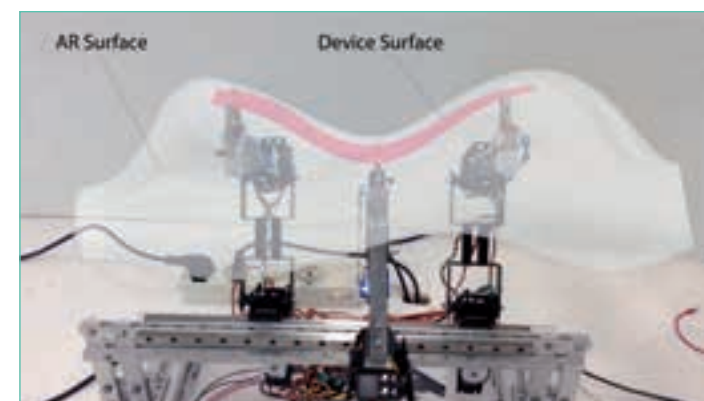


1. Proposed Product Design Process

currently available both on the market and in research labs. In addition, preliminary tests have been performed with a group of designers. Both the comparison and the testing session have achieved positive and satisfactory results, which have highlighted the high innovative potential of the system. Several are the benefits of the Tactile Display used in the initial conceptual phases of product design. The designers will be able to change the shape of a product according to the tactile evaluation, before the development of the physical prototype. This feature will allow decreasing the number of physical prototypes needed reducing, consequently, both cost and overall time of the product development process. Moreover, designers may improve their creativity during the product shape conception, since they will have the chance to optimise the design-evaluation process by evaluating visual and tactile properties at the same time. Future works have been presented, so as to indicate the future research to pursue in order to further improve the design process and the creativity of designers.



2. Prototype of the Tactile Display



3. Tactile Display integrated with Augmented Reality visualisation system

# AUDIOVISUAL STORYTELLING FOR DESIGN PROCESSES

**Walter Mattana** - Supervisor: **Maria Luisa Galbiati**

Today we are living in what sociologists and mess-mediologists described as the “narrative era”, where the attainment of the *narrative turn* interprets and transforms every object and every action in a matter of narration. Telling the world – and doing it through pictures – seems more easy and natural as never before.

As a part of the communication world, the various forms of audiovisual narrative have represented – and still represent – one of the most fertile soil in terms of research and experimentation. Over the last century moving images have established themselves as one of the most effective representation form of contemporary complexity. Audiovisual managed to go beyond the traditional barriers of written-oral languages – sometimes inaccessible – thanks to its nature of “language of images” and its intimistic narrative features, offering itself as one of the main keys to understand today’s society.

Nowadays, the strength of this communication phenomenon is fostered and boosted by the wide range of repro-visual instruments and devices and by the increasing popularity of digital distribution, sharing and archiving of audiovisual artifacts, especially for what concerns the bottom-up distribution and

consumption. So audiovisual presence has become pervasive, occupying spaces and places until recently inaccessible, and narrative has spread among varied and unexpected sectors, both social and corporate, entering rightfully in the processes of marketing, of corporate training, in politics and institutional communication, in clinical and psychological therapy.

Also in the design world the theme of narrative is increasingly common and it is used in many fields. In the same way the audiovisual communication focused on artifacts, products and services has become a customary practice, especially for what concerns the description of complex phenomena, in the construction of scenarios, in the documentation of design and manufacturing practices. In this way the designer also holds the role of a real communicator, able to design and to test languages and visual narratives in order to represent actual and future visions of a society in a constant transformation.

Unfortunately, however, the use of audiovisual storytelling in this context is often limited to an ancillary role or the synergic application of narrative and audiovisual strategies is not entirely effective. In many cases the cause of these problems

lies in a partial, simplistic and sometimes misleading interpretation of the narrative concept. Other times, the enthusiasm for a cultural fashion or the illusion of a brand new discovery leads to forget the existence of an well-established linguistic tradition. The enthusiasm with which different forms of storytelling are accepted, show how the field is still fertile and open to new experimentations, but at the same time are likely to turn into an ephemeral cultural revival. To declare indistinctly that “Nowadays, everything is storytelling”, or to call “narrative” any form of communication – even if it uses a little part of the discursive techniques – means to obscure, if not to ignore at all, the theoretical and linguistic narratology principles, that manage the story mechanism. This PhD research aims to address the communication landscape just discussed through a theoretical reflection about the role that the audiovisual has, and can have, in the design processes and on the opportunities that the visual narrative offers in terms of representation, of knowledge sharing and documentation. In order to facing these issues, this research seeks to converge on a unique frame of reference (what in the figure

is graphically represented as the “research circle”) three distinctive disciplines: the narratological theory, the media studies and the Movie Design (according with the definition of Marisa Galbiati). Starting from the studies of cognitivist psychologist Jerome Seymour Bruner and particularly from his concept of narrative thought, this thesis wants to point out the fact that storytelling is not merely identifiable with the ability to “tell stories” more or less interesting and credible, but is a real system of organization of thought and culture, a way of knowledge transmission which can involve both individuals and whole communities.

The following step involved the analysis of semiotics and narratological studies (Greimas, Todorov, Eco, Chatman, Campbell) in order to define what are the main elements and mechanisms that constitute any kind of story (fabula and discourse, characters, environments, time, conflicts) and to describe their particular characteristics as well as the relationships that bind them to each other. The subsequent investigation involved the nature of cinematographic language and the praxis of the filmic text analysis (Balász, Metz, Aumont, Marie, Elsaesser, Burch, Morin, Žižek); the theoretical milieu which contributed the



1. Scheme of the disciplines involved in this research

definition of the grammatical statutes and the syntax of audiovisual narrative. A moment to assert, once again, the close integration between the world of narrative and the world of moving pictures, a bond born in the past – as we learn from the history of cinema – that helps to spread audiovisual storytelling as a mean of interpretation, dialogue and cultural access. The last phase is dedicated to the analysis of a particular cinematographic genre: the industrial film. In the multifaceted world of cinema products, this kind of films has represented the real ground of exchange among the design processes, the industrial manufacturing practices and the filmic communication. An area where it was possible to experience visual narrative solutions for make the industrial tasks more clear and

understandable. Discover and analyze the filmic material that is emerging today from the company archives also means to shed light on the practices with which the different design areas have tried to represent themselves.

Located at the crossroads of narrative, cinema and the tradition of the utility films, the audiovisual storytelling could be turning – in recent times – into a tool for sharing projects and for facilitating the design more aware. In this way the audiovisual narrative become the true mediator capable of activating what John Grierson – one of the fathers of documentary films – defined as “the creative treatment of reality”.

## DESIGN OF THE UN-FINISHED.

### Information visualization in mapping social issues through the web

**Michele Mauri** - Supervisor: **Paolo Ciuccarelli**

The web is progressively becoming the place where we are shaping the image of our society: social interactions, news, official and unofficial documents are increasingly archived online. Any public issue and concern hits the web, leaving traces of ongoing debates. The rising questions are: how can we use these traces to investigate social issues, such as the adaptation to climate change? Is it possible to map these traces to gather a big picture of the phenomenon? While the web is a place where multiple actors are engaging in discussions about these issues, several biases affect this medium. Not all the world's population has equal access to it, not all the debates are public, and the loudness of involved actors can be amplified or weakened by the web as medium. This makes the web an unsuitable source to understand a social issue, as our perception can be influenced by those biases. At the same time, the web is the perfect place for looking at the public discussion about issues. On the web is possible to see who are the most active actors involved in the debate, which are the factions and the fractures among them, how these relationships change over time.

In the fields of social sciences and new media studies it is possible to see a rising

approach looking at the web as a space of discussion that can be mapped. Adopting a cartographic metaphor, the social scientist is seen as a cartographer, who explores and describes the debate landscape. Outputs of these studies are therefore maps and atlases, which can be shared with involved actors to understand their position in the debate. Such approaches provide a sound framework to repurpose digital traces for social research. There is a demand for new visual languages able to express the complexity of these studies: communication design expertise, in particular from the information visualization field, is needed. Diagrams are powerful tools capable of expressing different layers of the debate, allowing a formalization of results providing at the same time a seamless exploration of them, from the macro to the micro view on debate. While these approaches have been already discussed in other fields, few reflections have been done on the role of design within the creation of such artifacts. A European project that joined researchers from the social sciences, new media studies and design fields has made possible to analyze the role of diagrammatic tools in issues and controversy mapping. Two issues have been identified as case

studies: the ageing phenomenon in Europe and the adaptation to climate change. With a first round of experimentations, it has been possible to see that design expertise is not only related to public communication, but influences the analysis process too. Visual artifacts are indeed used by researchers into the analysis process, to validate results and identify errors and pitfalls.

This research is therefore framed to explore the influence of visual artifact within the analysis of social issues from the web. The aim is to identify needs and criticalities whose solution is supported by design expertise. Developing visual and interactive artifacts within the project, it has been possible to analyze how researchers and end-users engage in the use of visual artifacts. The project gave us the ability to follow "in vivo" the whole process of a social cartography, observing the analysis methods evolution, the criticalities related to the data collection and to their visual translation. Furthermore the project allowed testing different design approaches and visual languages, producing several diagrams and a web-platform for controversy explorations. Beyond the achieved results, we also had the ability to identify design approaches able to improve the analysis.

The first part of this research grounds the mapping of debates from the web into the literature, identifying the main concepts and relating them to the visual analysis of social phenomena. Those concepts are not relevant as background information but rather for the definition of design directions. Analyzing issue-mapping studies carried out in the last years, emerges that most of them are based on the study of "digital objects", seen as the ontological object provided by each platform (such as website, social networks, search engines) on the web. As designers, we need to know the features of materials we'll use to produce artifacts. The process of encoding digital objects into data is therefore investigated. First, an analysis of "digital object" concept is carried out, highlighting the authorial choices that must be taken for its translation into data. Then, a classification of digital sources is suggested, describing the characteristics of digitized objects, born-digital objects and re-born digital objects. From the analysis of already existing tools, five approaches for repurposing and translating digital objects are identified, depending on the access provided by different platforms. For each one, repercussions on design process are analyzed. Furthermore the research draws connections with communication design and information visualization. Finally, an analysis of the project experience is proposed, drawing on failures and successes achieved along the process. The limits of the cartographic metaphor are explained and a new approach to analysis is therefore proposed. The

metaphor has strong influences on the design process, as it suggests that maps can be drawn while exploring the territory. From the practical experience, a two-fold movement emerges: first, an exploration of the topic, in which visual artifacts are used in quick and frequent iterations by researchers to validate results, identify errors, and identify new analysis direction. The second movement is the way back toward the end-user, in which artifacts are repurposed, redesigned and enriched in order to make explicit all the assumptions taken by the researcher in the exploratory phase. From this analysis two main concepts are argued. The first one is that visual artifacts must be considered as semi-finished products, or materials, supporting the analysis. Identifying researchers as main users, artifacts core features are the quickness of execution, simplicity in re-executing them, and the openness to new analysis actions starting from them. Semi-products become outdated at the moment of their reading, their use is purely functional to identify new research directions. The second concept is closely related to the previous one, as the openness of an artifact is not a by-product of visualizations but it must be designed: therefore design actions must be mainly focused on developing un-finished artifacts, which are open to be repurposed and edited. Finally these artifacts can be used at the end of the study to rebuild the analysis evolution, and to identify key concepts and findings that should be communicated to the end user.



## MUSEUMS FOR THE INTERCULTURAL CITY. DESIGNING FOR/THROUGH LOCAL MUSEUMS AND HERITAGE IN MULTICULTURAL TOWNS AND CITIES

Lucia Parrino - Supervisor: Prof. Eleonora Lupo

Although diversity has always been a fundamental characteristic of human societies, now more than ever, it is central to the political and research agenda. Contextually, the socially active role of museums and heritage has become intertwined with cultural diversity and intercultural dialogue, and design research and practice have become increasingly interested in addressing social and societal issues.

In the light of this, my study developed from a generic interest in how museums and design could have a role in addressing local cultural diversity issues, such as intercultural relationships and tensions, integration processes and so forth.

With the first phase of the research—through literature review, contacts with experts, exploration of case studies and participatory action research—I moved from this generic interest to a more structured conceptual framework and related aim: providing local museums with guidance on how to activate bottom-up the elements of the Intercultural City approach, even in the absence of a local policy framework that embraces this strategy.

The concept of Intercultural City refers to an approach for the management of diversity in

urban contexts that conceives diversity as a source of dynamism, innovation, creativity and growth, and stresses the importance of interpersonal and intercultural encounters. In Europe, the development of this approach went hand in hand with the *Intercultural Cities Programme*, a joint action of the Council of Europe and the European Commission.

My study is aimed at supporting especially local museums, which, because of their being “implicated in the territory”, are accounted as privileged institutions for being relevant locally. By virtue of its aspirational dimension and its acknowledgement by European institutions and policy networks, I have identified the Intercultural City approach as a reference for addressing the work of local museums, which are regarded as tools potentially able to influence local dynamics. In line with those design approaches that acknowledge people’s and organisations’ creativity and empower them in finding their own specific solutions, the outcome of the study is a metadesign framework guiding museums in designing their interventions. This is based on the idea of the ten elements of an intercultural strategy suggested by the Council of Europe. These suggestions are mainly addressed to local

governments and policy-makers. Therefore, in elaborating the metadesign framework, I have selected and reinterpreted them in light of what local museums can concretely do. This translation was influenced and addressed by the museum practices and projects observed during the first phase of the research, all of them originally conceived and designed without any explicit reference to the Intercultural City objectives. Furthermore, the premise for the kinds of suggestions included in the framework lies in the idea of design practice as aimed at designing for and through museums, seen as transformative services for local communities. This vision was informed by the transformation design practices observed and developed during the research process, such as *Small Works Hackney* by Clear Village. Lastly, based on the case of MUST-Museo del Territorio Vimercatese and on my active involvement in the design process of the exhibition *Parole per accogliere. Parole da cogliere*, I have reflected on how the Intercultural City metadesign framework can be used in the specific context of MUST and its territory.

With my study, from the point of view of museums, I have formalised a reference that would guide the work of

local museums in relation to intercultural integration policies and practices. This can be used both to support museums and their partners in designing their interventions and to evaluate the compliance with intercultural integration policies of their existing activities. The formalisation of such framework is in line with the guiding approach embraced by museum think tanks and associations with reference to cultural diversity and social inclusion and impact. From the perspective of design, the study has offered new viewpoints and experiences on the relationship between transformation design and design for cultural heritage when designing in and for multicultural places. In particular, I have framed in the context of design for cultural heritage the idea of museums



1. *Marlborough Square Project* exhibition within *Small Works Hackney*. © Clear Village.



2. *Parole per accogliere. Parole da cogliere* at MUST-Museo del Territorio Vimercatese. © COI.



# THEORETICAL/PRACTICAL STUDY OF AN INNOVATIVE METHODOLOGY FOR MEDICAL DESIGN: APPLICATION TO A WEARABLE BIOMEDICAL SYSTEM

**Paolo Perego** - Supervisor: **Prof. eng. Giuseppe Andreoni**

In the last decade, the trends in the development and management of national healthcare service are focused on telemedicine with the aim of cost reduction. Telemedicine can be useful to reduce cost thanks to early de-hospitalization and diagnosis. These development drivers can be achieved only through the use of new technology oriented to the production of low cost products, which can be integrated with existing system in order to improve monitoring quality and possibility. The application of these technologies on sensible aspects has to face the main issue of user acceptance and usability.

Usability shows how a product can be exploit by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specific context of use (ISO 26800 – Ergonomics. General approach, principles and concepts, ISO 9241-11 hardware usability and ISO/IEC 9126 software usability). The acceptance is instead defined as how the information technology can be accepted or rejected by people. In particular:

- Perceived usefulness: The degree to which a person believes that using a particular system would enhance his or her job performance.
- Perceived ease of use: the degree to which a person

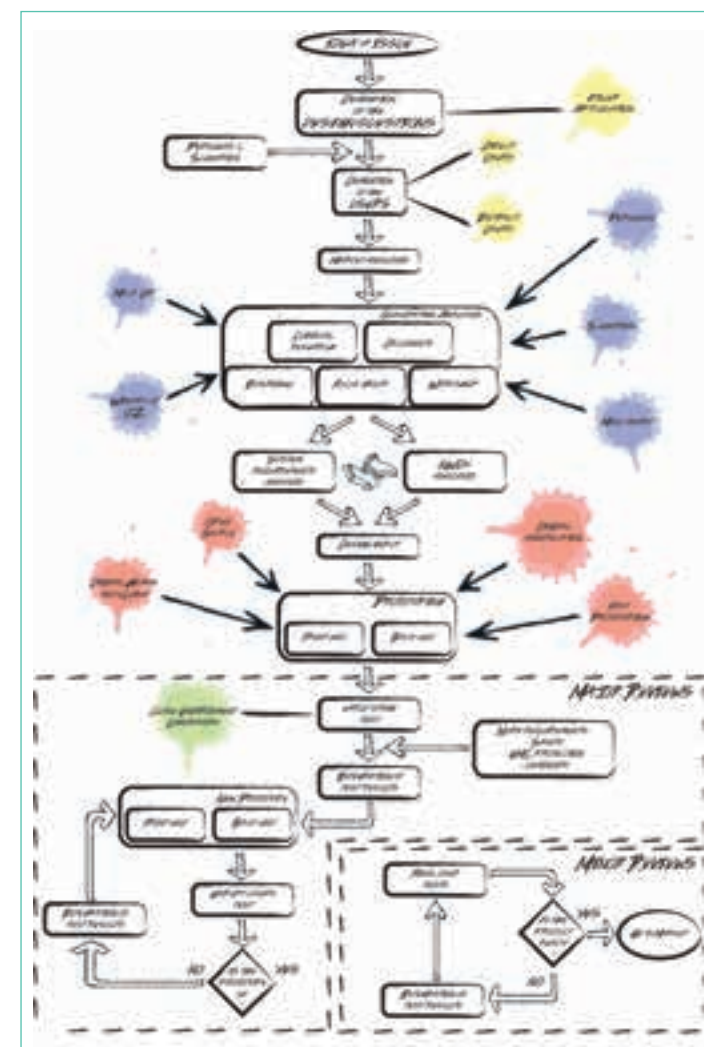
believes that using a particular system would be free of effort. Starting from these two concepts, this doctoral thesis study a new method for the development of a new biomedical device for telemedicine. The research has been divided into five parts. The first part concerns on users: the research focuses on studying market and epidemiology in order to identify who are the users that will use the products, which are their main features and how many different kinds of users the product has to meet. Once the users have been selected, the research focuses on these subjects in order to extract the user NWDs (Needs, Wants, Desires). These operation has been done using some qualitative analysis technique (Interview, Focus groups, Workshop...). In this research, the work with the users, and particularly the qualitative analysis, is accomplish both in the early and final stage of development. This method allows for optimizing the design of the product minimizing the cost of development. Users are also involved in the final tests to verify two main aspects: the usability (how the system is easy to use) and the efficiency (how the device is able to give correct and reliable outputs to the users). The second part explain the technics (interviews, focus

groups, workshops...) used for acquiring data from users in different stages of development. The users NWDs are then exploited as main inputs to build the new biomedical device. The third part consists in the development of the hardware; this work uses a concrete system development example to demonstrate the proposed reliability and the applied method. This method is specifically applied in the development of a wearable system, device and smart garment, for weak people. The system has the purpose to continuously monitor the cardiac state of the subjects (weak users). The weak users are defined in this case as babies and elderlies. The process shows different stage of development with some subsequent version of the hardware due to the integration of data and idea arising from the users involvement and from the data acquired through the qualitative analysis.

The forth part is similar to the third but concerns on the software of the system. In this part the research focuses on the development of software (particularly GUI - Graphical User Interface) starting from the users NWDs highlighted in the previous step. In this forth part, different procedure for Mock-up and Wizard of Oz

have been used in order to retrieve information form the users which could be otherwise gathered only in the final test phase. In this part the thesis shows all the techniques used for developing software mock-up and then the real software/ apps necessary for signal acquisition, processing and visualization.

The last chapters of the thesis reports data form the final test of the system with real users as well as the problems, future developments and conclusion.



1. Outline methodology for healthcare product/system development.

## FAKING NATURE

**Davide Rapp** - Relatore: **Maurizio Vogliazzo**

The forms, the colours and the mechanisms of *Nature* have always been an influence on the production of objects and the design processes at different scales, both *indoor* and *outdoor*. This influence reveals itself in an often unbalanced mix of imitation and invention, simple resemblance and understanding of deeper mechanisms. Today industrial design seems to be progressively acquiring an *hybrid character* that aims at the creation of objects inspired by natural processes, through the integration of technology and biology. As a result, an ever-growing *environmental awareness* gave the birth of a *design for sustainability* or, in its most simplistic and *popular* reduction, to the so-called *green design*.

The use of the word *green*, adopted *in lieu* of the term *sustainable*, coincides with the attempt to reinstate the image of *design* as natural practice, symbolic and positive, by referring to Nature's most evident and superficial characteristic: *its colour*. This exchange gives way to contradictions and linguistic ambiguities: on the one hand *green design* promotes objects that are environmentally aware; on the other hand it allows for the creation of designs that are far removed from any ecological value and that are hidden under

a *green make-up*, a *camouflage* that can be either chromatic or formal. It is the contradictory and double-nature dimension of objects of natural appearance, products that create a *fake Nature* within the domestic walls.

This *false environment* - populated by *trees/clothes* hangers, *grass fields/carpets* and *cactus/toilet brushes* - is amplified by the technical possibility to reproduce every environmental condition in a closed environment. Air conditioned *hangars* guarantee - 24 hours a day, 7 days a week, 365 days a year - snow covered tracks in Dubai and tropical beaches in Berlin. And what happens *outdoors*? Mobile phone towers *disguised as pine trees* are hiding in the woods, accompanied by the first specimen of *photovoltaic trees*. Do we still have the genuine experience of nature? Where is the boundary between reproduction and imposture? Are we setting up a fake domestic nature in order to replace the real one? The research project aims at ordering and interpreting design practices that are inspired by the forms and mechanisms of nature, to determine the characters of the *fake Nature* that is made up of objects, materials and environments simply interpreted in a

naturalistic key.

The different contents of the research are articulated in a continuous stream of text, images and graphic apparatus, using diversified linguistic approaches. In *the first part* the juxtaposition of photographs, drawings and diagrams - collected and selected over three years - represents a selection of design experiences without the use of words. A series of over 100 images creates a sequence of *case study couples* in order to try and determine ambiguities and contradictions in the design practices inspired by *Nature* from the end of the 60's till today. The images, edited and hosted within the same graphic frame are alternated, revealing visual assonances and dissonances. In the descriptive texts the reiteration of the same analytical structure - description of case *a*, description of case *b*, confrontation between cases *a* and *b* - defines a systematic and homogenous way of reading. The sequence of texts and images follows a reverse scale order, going progressively from landscape to object. In *the second part* the drawing becomes the decisive instrument of enquiry. The research proposes a *taxonomy system* that is able to order and interpret the languages, functionalities and contradictions

of the peculiar category of objects: the analysis of formal, dimensional, chromatic, material and descriptive characteristics of over 200 objects is rendered through 70 different graphic boards, divided into 3 distinct list. An *herbarium*, a *bestiarium* and a *lapidarium* show the collections of objects that have a false *vegetal*, *animal* and *mineral* appearances. By changing graphics, words and classification practices inspired by the natural sciences, the different specimen are interpreted from a transversal point of view, unbound from functionality and aiming at pinpointing the recurrent characters of reproduction and falsification of the natural components.

The graphical rendition - in plan and elevation - of the 200 selected examples, allows for their systematic study and defines the necessary database - homogenous - which is the base for the analytic phase. The objects are re-read and interpreted starting from their appearance, from the correspondence of their form to a kingdom and specie, coherently with the intentions declared by the designers and brands. By forgoing a classification based solely on function it is possible to notice differences and analogies between specimens that mimic the same natural element, in an enquiry that overturns the ironic and analytic attitude of Bruno Munari who, in *Good Design* (1963) transfigures fruit, vegetables and flowers into objects.

The composition of the taxonomical boards highlights characteristics and details which

would be difficult to analyze through catalogue pictures. The confrontation of the boards - made *ad hoc* - and the commercial description of the objects - provided by designer and companies - underlines dissonances between design intentions and outcomes. Analytic statistics on materials and prevailing colours take the specimens back to that concreteness that - as functional objects - they possess. Photographs, drawings and analytic texts take turn in describing the object of the enquiry - a *fake Nature* that proliferates both *indoor* and *outdoor* - through a transversal and multilayered gaze. In the described design experiences, the use of forms, colours and words taken from the natural world - ideal and abstract - is intertwined with expectations - often disappointed - of environmental respect and safeguard, uncovering a desire for legitimization which is dominantly *aesthetic*.



1. Fake Herbarium, leaves.



2. Fake Bestiarium, birds.



3. Fake Lapidarium, stones.

## NAVIGATING THROUGH TRENDS AND ANTICIPATION: AN ADVANCED DESIGN PERSPECTIVE ON REFRAMING PRACTICES

Jennifer-Ellen Rudkin - Relatore: Flaviano Celaschi - Co-relatore: Manuela Celi

This research results from the observation of a constantly changing design landscape, repetitions, alterations, and disruptions, a flow of information that are as many representations of innovation. Paced by a continuous update of its productions, Design activity is driven by a goal - the improvement of the quality of life. However, innovation does not always come out as novelty nor as improvement. In the very least, each design action reveals itself differently depending on the perspective we bring to bear on it. As a result, it is difficult to ascertain the designer's political and/or social commitment in any new production. As per this assessment, the following questions are raised: What are the driving forces that determine the direction and outcome of a design production? How much control over change is in the hands of the designer? How does design take charge of the future?

The methodology adopted to answer these questions is mainly qualitative, beginning from an opportunity space rather than a problem space and refining the domain of inquiry along with the acquisition of knowledge. The study takes place, within the context of an Advanced Design framework, driven by four characteristics: design anticipation; design in absence

of market constraints, disruptive design and design of meta-tools - the components of a process (Celaschi, 2014; Celi, 2014). In accordance, the research positions itself at the "Fuzzy Front End of Innovation" recognized as a problematic space for the Design activity due to the strong implications of insight and tacit knowledge. The argument that a conscious and/or unconscious implication of trends at the early stages of the design process, can direct the project towards a meaningful innovation has weaknesses. These can be addressed by a variant approach that seeks to make better sense of the contemporaneity of change. The flux, as the backbone of the research, connects all the parts together as well as it connects objects to meaning, to people, to nature, to space and time. And those are the many connections to integrate at the beginning of the design process when gleaning information, framing the field of action, envisioning the new, and reiterating the process for the fine-tuning of the imagined possibilities. All of this contributes to building the future. A future that, according to the design literature, encompasses three expectations: critical, sustainable and creative. Anticipation and Design are intimately connected. The first

and most direct demonstration that comes to mind, is reference to the Italian derivative of the word design, *progettazione*, meaning to project, to set forth, directly connecting design and future. To Design is to Project. From this vantage point the study moved towards the exploration of anticipation as an approach embedded in other disciplines. This lead initially to a comparative analysis of the many fields that use anticipation. Then, to a focus on the three fields that are most implicated in the gathering of qualitative information, mainly socially situated trends; i.e. Fashion, Foresight and Design. Taking into account the importance of trends within the socially engaged practices of Fashion, Foresight and Design, raises the question, '**Should we reconcile with trends?**' Looking into trends is a difficult task because of the many layers of meaning that have been given to them and the mystical powers that come into play. Nevertheless, the study finds its way through the confusion of appearances within the three disputed fields, by kneading the trend's representation and via experiments that reveal the limits of its mechanism and content. The experiments rely on the field of food, given that it seems safe to expect that food is a constant human need.

Unlike other design productions that can easily disappear, food is therefore a stable basis that contrasts with fleeting trends and allows perception of change. The findings underpin the untamable quality of trends; interconnected, open structures that irradiate, multiply and release contagious energies that annul all distinction between past, present and future. The trend, in its living state, is of interest to the design project in search of pieces of information that will make the difference in social and cultural contexts and in the future.

Keeping the frame of the research fixed on the early stages of the design process, having made sense of the perceivable representations of change, the inquiry moves to the analysis of the terrain where change is most effervescent, **the present**. The hypothesis that emerged from the study of trends is that people may be the best informants of meaningful change, placing all their expectations in the moment not yet formed - the future. This analysis begins by questioning the motivations of participatory co-design practices and rapidly moves into a debate on creativity. This issue, motivated by a will to change becomes stifled because of collective consensus and biases. Design is not concerned only

with the question of designing **functions**, but more so with that of designing **behaviors**. The conversations are necessary for the design process, but the way in which people participate in creating a design vision is not systematic and can happen at different levels. This is confirmed by the many possibilities of interpreting the present. The **now** is multifaceted, mixing past, future and experienced moments, its richness is recognized by Future Studies that do not **predict** the future but look at the way in which the present can inform the creation of alternatives paths.

Finally, the findings suggests the need to implement '**stand-by tricks**' for developing awareness of the many realities that make up the thickness of the present. **Reframing**, as a practice that allows the offset of preconceived ideas of what the future should look like, is illustrated with examples taken from various disciplines of anticipation. The underlying idea is that reframing offers the capacity to adapt to change and to grasp the emerging challenges of the present – this, as a consequence of open meaningful conversations driven by sincere creativity. The Advanced intervention of design is recognized by the potential of the design practitioner to continuously step aside, giving

room to recognize change that will nurturing innovation, a designer meditator, trickster, magnifier, and advanced designer.



## SENSEMAKING IN FURNITURE DESIGN

**Francesco Ruffa** - Supervisor: **Agnese Rebaglio**

Contemporary home environment comes from the disintegration of traditional symbolic structures. The emancipation from bourgeois moral tensions allows us a new structuration of environment. Dweller puts personally pieces of furniture in his own home environment and can wonder about on the links furniture maintains with its formal quality, the production that generated it, the actions it invites to perform or the interactions it makes possible. The new setting is no more symbolic. The pieces of furniture do not comply with a predetermined order but represent the worldview of the person who combined them together.

Home furniture is generally considered low-tech and requires research mainly in the not technological area of meaning. Furthermore, semantic experience has generally a perceptive origin and is linked more to the manifest meanings deriving from cultural context than to the latent meanings experienced in use and appropriation of object. We can consider a piece of furniture as a sign, which we sense, and it signifies the connection between us and the culture we belong to. Therefore, semiotics is central in this work, because it is the discipline studying sign and in particular

the relationship between sign and its 'other', its signified concept. According to a first general classification, semiotics of last century has lived a contrast between two capital theoretical lines. One is the linguistic theory, which lets us replace a sign with a meaning determined by convention. The other one is born from the contribution of Charles Sanders Peirce and is based on a logical-cognitive system allowing the interpretation of sign as an inference. This work refers to Peirce's Semiotics, involving interpretation. If culture were a simple system of conventional symbols, experience would be only recognition. But, if culture is seen as a continuous interactive process which we cannot simplify, something new may join experience through the interpretation of intrinsic features of object. In other words, experience of project and interpretation, on which Peirce's Semiotics focuses on, are strongly linked. The core of the strategic design of furniture is an interpretative activity mostly involving the existing artifacts of reference sector. This activity is essentially an abductive process informed by inference, and we can call it sensemaking. A methodology would allow

designers / art directors to visualize and organize the process of sensemaking. The advantages would be various, in addition to determining effective innovation paths: sharing interpretative process with other members of design team and with other corporate areas; transferring the interpretative criterion within company, limiting the importance of individuals; facilitating the relationship with clients or managers, who would understand more easily the influence of research work on the result. Nevertheless, the most designers do not follow a systematic methodology, but they instinctively interpret objects by counting on their experience, without a real externalization. Semiotics and methodology are convergent issues: we can mean design semiotics as a methodology, study of methods specifying where and how to order and interpret the objects of a system where we have to act. We use this methodology to define what is possible to do, which is both understanding links of meaning (sensemaking) and being able to managing them (sensegiving). After a theoretical discussion, the process of sensemaking systematized in this thesis considers each piece of furniture as a design entity evoking one

principal concept in interpreter's mind. Each object can get four kinds of relationship with concept: *similarity, effectuality, causality and convention*. In a relationship of *similarity*, a piece of furniture imitates with qualitative differentiations a concrete object. Similarity tends to promote the *expression* of designer in the imitation of the physical thing directly represented. In a relationship of *effectuality*, a piece of furniture is meant as trace of a certain past activity – a technique of production, the use of a material, a local decoration, etc. The main goal of designer lies in the *selection* of this social practice. In a condition of *causality*, a piece of furniture facilitates a determined future action. Here the goal of designer is the *exhortation* of a wished action toward a passive subject. The relationship of *convention*, finally, is based on a piece of furniture sharing with user a code necessary to understand its performing properties. The central issue of this representation is the *participation* of person in performance. Domestic furniture, more than other objects, represents the links of man in respect to himself or other people. It links or divides individuals, and takes on formal properties of differentiation or integration. Furniture shows unique qualities to represent user's internally order, whereas it shows collective practices to emphasize social identity. If we focus on the four identified semantic areas, we can see that two of them – *similarity / expression* and *causality /*

*exhortation* – tend to promote a differentiation of both shape and individual in respect of the reference context. The other two areas – *effectuality / selection* and *convention / participation* – emphasize the integration of an external order. Well-balanced furniture may have different forms of relationship with concept, including both the presence of community – through effectuality or convention – and the personal connection between designer and consumer – through similarity or causality. Finally, the thesis formulates a guiding principle for the the generation of a concept map. This represents graphically the mental model of creators and guides understanding of gathered material both by the creation (implying a value judgment) and by the visualization (illustrating connections). Design team progressively places and organizes – according to semantic areas – pictures taken from reference context and may integrate the map with notes, based on personal experiences. The map may be a big physical surface or a digital file, with dynamic nature and the option to be shared. The actions of mapping come in a circular way:

1. Collecting and organizing images in accordance with the four mentioned areas;
2. Grouping images according to homogeneous evoked concepts;
3. Connecting groups of images placed in all areas in accordance to common cultural macro-themes.

The creation and the use of a concept map provide semantically coherent groups of

furniture, able to evoke cultural issues which they are traces of. These groups form design patterns, from which sensegiving starts. In the case of a market-pull process, where pursued innovation is incremental, design decision can overlap to one design pattern. If the goal is formulating disrupting ideas, art director can use a method called insight combination: individual insights of design issue are linked one-to-one to single design patterns, which later are creatively combined to look for new semantic keys. The main value of this research lies in considering the whole conscious experience, by evaluating it not only for what is based on convention but also for not symbolic meanings, experienced and interpreted directly. In furniture design – like in arts – subject may suppose sender's purpose through an interpretative approach, similar to that one applied to natural phenomena. This thesis sets up a meaning theory more congruent with design practice, dealing with a not always codified relationship between designer and consumer.



## DESIGN PROCESSES FOR ONLINE KNOWLEDGE, USE AND ENHANCEMENT OF ARCHIVES AND THE MODERN ARCHITECTURAL HERITAGE

Anna Santi - Supervisor: Prof. Fulvio Irace



Analog/Digital archives

The research starts with a reconsideration of the humanistic model of information transmission, here represented by the archives, highlighting the new possibilities offered by digital technologies. Although specifically focusing on architecture and design archives, the thesis discusses the changing patterns in information communication in contemporary society, which embodies strong technological features, trying to make connections between the humanistic and scientific fields. The conviction gained over the years of theoretical research and action in some of the most important archive institutions in this field -- such as the Canadian Centre for architecture

in Montreal, the Royal Institute or British Architects in London, the Netherland Institute of Architecture in Rotterdam, the Museo delle Arti del XXI secolo and the Museo di Arte Moderna e Contemporanea di Trento e Rovereto, among others, is that digital technologies and participative models amplify the opportunities for the diffusion of information of archives' materials. Architecture and design digital archives, with databases and descriptive metadata, reproductions, 3D models, audio and video, displayed on portals and websites and integrated with new-generation content, become media platforms and new communication models

for a dynamic and open diffusion. Internet is the logical extension of free access to archive institutions: intuitive interfaces, efficient search engines and attractive electronic devices foster the attention and engagement for new forms of informal learning, potential knowledge experiences, as well as new curatorial and scientific horizons, without physical or temporal boundaries. Digital archives of architecture and design, although in their niche discipline, contribute to the spiraling growth of digital heritage by circulating representations of a rich and extravagant repertoire: drawings, sketches, notes, models, photographs, audio, video, etc., often activated via typologies, thematic paths, geo localizations, etc. They preserve the testimonies of architecture, objects and creative thoughts on design of the modern heritage that built the today contemporary landscapes forging contemporary aesthetics. Great masters, such as Le Corbusier, Gropius, Mies van der Rohe, Aalto, in Europe; Whright and Buckminster Fuller in the USA, in Italy, Terragni, Figini, Pollini, Libera, Lingeri, along with Ponti, Michelucci, Pagano, Moretti, then the group BBPR, Magistretti, Castiglioni, Albini, Gardella, among others, have become milestones in the



Architectural archive institutions\_map

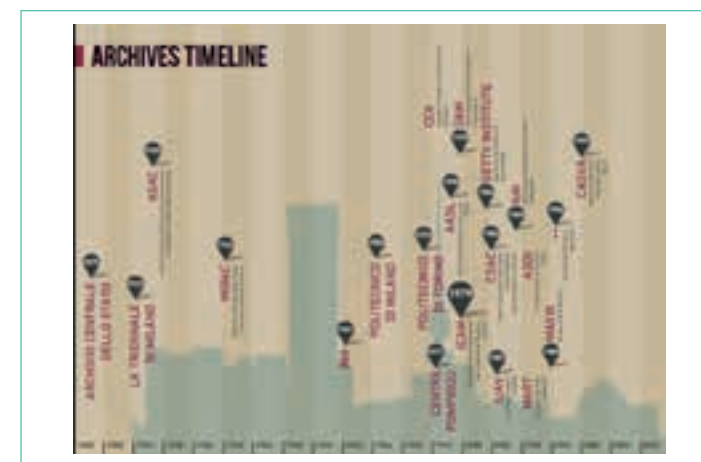
history of modern architecture and references for entire generations, for helping spread a modern idea of living by the principles of geometric rigor, functionality, new technologies and innovative materials. As a witness of evolution in progress, the research examines how digitization and online dissemination of archival content entail a necessary redefinition of the archive's role and activities, stimulating a radical rethinking of the entire institutional organization and representation open for a wider audience. The interactive, multimedia and participatory digital models present new opportunities for the enhancement and fruition in both the organization of the exhibition (exhibitions in situ) and dissemination in the network (portals and websites):

- exhibitions and cultural programs *in situ* open up to transversal variations of design topics (planning, architecture, design, territory, etc.), and to issues of contemporaneity (environment, climate, urban development, health,

migration, etc.). Furthermore, they include the contribution and participation of visitors and open their collections cyclically putting all the materials from the archives on display;

- web sites and portals as authentic publishing projects are considered the new communication tools for online dissemination. They also provide fertile testing ground for communication design. as platforms of multimedia experience. As platforms of

multimedia experience they exhibit the characteristics and activities of each institution. The innovative categories of enhancement and communication of the archives contribute to the transformation and updating of the archives and to the definition of new social and cultural practices, while attempting to provide answers to meaning of the role of archives today, through the promotion of their contents, new curatorial processes, new professionals and the public engagement. The research attempts to demonstrate how the informative and interactive principle of technologies, coupled with favorable social dynamics, presents an opportunity for the archives to be transformed into many "piazze del sapere", where everyone can find, identify, and nurture their own interest, and memories can be relived through free and creative forms of interpretation and elaboration; those infinite narratives able to weave the threads of the past with those of the future.



Architectural archive institutions\_timeline

## DESIGN FOR PUBLIC-INTEREST SERVICES.

### Citizen participation and collaborative infrastructures in times of societal transformation

**Daniela Selloni** - Supervisor: **Anna Meroni**

This doctoral research originates from observation of those people who are most active in our society: groups of citizens who self-organize to solve their own problems, by starting to transform what is already there without waiting for a bigger, top-down change.

Creative communities, active citizenship, social movements, whatever you want to call them, these forms of activism are shaping our cities and they are developing an alternative system of services between amateur and professional, public and private, market and society, profit and not for profit.

This starting point is a positive phenomenon, even moving from a context characterized by wide social and economic transformations that have resulted in a long crisis. In fact, the first part of this doctoral dissertation is devoted to framing the renewed activism on the part of citizens, by connecting it with the wider concept of social innovation and drawing a system of relationships with new forms of economy, such as collaborative consumption or sharing economy and new forms of welfare, known as relational welfare, second welfare etc. All these movements basically explore new ways of offering services and this is the author's specific interest as a researcher

in design for services, which represents the main area of study in this doctoral dissertation. Hence, the author attempted to develop these new forms of service by creating the definition of 'public-interest services', which focuses on its hybrid nature: the provider of such services is a system composed of different actors sharing the same values and acting in the public interest; they are services that emerge from the bottom-up and they often show a high level of disorganization and transience, sometimes they are just initiatives that are not able to evolve.

The author questioned what design can do for such activities, not only design for services, but also participatory design and all forms of co-creation that range from co-design to co-production, precisely because the protagonists of these initiatives are users, citizens who already practise collaboration and sharing. The research question is therefore a series of consequential questions: how not to waste citizen activism? How to strengthen the various bottom-up initiatives? How to transform these activities into public-interest services that are effective, efficient, and sustainable both from an environmental and social

point of view? What kind of infrastructure could support this transformation? How could design contribute in creating this infrastructure?

The term 'infrastructure' and the related verb 'infrastructuring' are crucial for this doctoral dissertation, because they are the 'object' and 'action', indeed the 'product' and 'process' of the research. Therefore the hypothesis is that the creation of a dedicated infrastructure to co-design with citizens building upon their existing initiatives may avoid their weakening and ultimate failure, facilitating the emergence of a new generation of public-interest services and the creation of a catalyst for local change, hopefully fostering the encounter between the top-down (institutions) and the bottom-up (active citizens).

To verify this hypothesis the author adopted a methodology that combines two major strategies: case studies and participatory action research. For the former, she analysed existing practices, and for the latter, she carried out research testing one possible infrastructure to support specific initiatives in a selected context.

In exploring case studies the author analysed existing forms of activism and collaboration, from civic participation networks, to social movements, public art and collaborative

services in various fields of daily life. Thus she attempted to understand if there are existing infrastructures dedicated to support such activities and this exploration produced a taxonomy of places, entities and organizations defined as 'Public Innovation Places.'

In her participatory action research experimentation, the author immersed herself in a specific context: Zone 4 in the city of Milan. She started with this neighbourhood because there was already a high level of citizen activism that she had encountered when working with Polimi DESIS Lab on the project 'Feeding Milan – Energy for changes', which is dedicated to exploring new types of food systems. And therefore food became the key-subject around which she established a fundamental connection with this community of citizens. After one-year's immersion within the local context, the author developed the project 'Creative Citizens', a programme of weekly co-design sessions on four main topics: food services, services for sharing goods and skills, cultural services, legal and bureaucratic services. 'Creative Citizens' is at the centre of this doctoral research because it researched an actual infrastructuring process in the existing initiatives, by using design for services and participatory design and thus creating a meeting space for citizens, designers, local stakeholders and institutions, if only for six months and on a small scale.

Furthermore, the author was able to extend her participatory action research to a second context: the Lower East Side

in New York City. Here she researched another type of infrastructure: the 'NYC Office of Public Imagination', focused essentially on the collaboration between citizens and the Municipality of New York and thus exploring an innovative connection between bottom-up and top-down through participatory design.

The results of this doctoral dissertation can be divided into two main parts: one focuses on services generated during 'Creative Citizens' and the related service model, the other discusses a collaborative infrastructure to co-design and co-produce public-interest services.

The first part considers the services originated within 'Creative Citizens' as actual results. This is perhaps an element of originality: the general purpose of a PhD is to produce new knowledge about a topic, and, in this case, a methodology based on action research also led to the creation of effective field results, six services (Objects' Library, Augmented Time Bank, Citizens Help Desk, Facecook, Local Distribution System, Zone 4 Ciceros) that are currently evolving in different directions and have produced an impact on the neighbourhood. On the basis of these results the author attempted to extract a service model, building upon that of collaborative services and outlining a set of characteristics. The second part of the results has a wider perspective: it offers a model for infrastructuring informal activities in public-interest services, describing a process that is potentially replicable in other contexts,

starting from meeting a community and going through the phases of co-design, co-production and co-management. This focuses more on participatory design and social innovation, and developing several aspects. The first deals with the idea of creating a 'fab-lab of services', the second reflects on a possible financial model for these infrastructures, building upon the notions of 'corporate social responsibility' and 'shared value'. Finally, the author reflected on the role of designer within these processes: from the traditional role as 'facilitator with tools' to the more recent one as 'activist with proposals', and she introduced a possible role of 'designer as advocate' sustaining citizens' initiatives.

In this doctoral research the author essentially reflected on how to design new forms of citizen participation within society, aiming at supporting public interest, which is also connected to the design of new forms of democracy and of the re-distribution of power. Design is entering unprecedented stages: this is an open question for further research, in which the relationship of design, democracy and politics will form the starting point.

# INTERFACE DESIGN FOR USER DECISION IMPROVEMENT IN E-COMMERCE

**Dongning Yan** - Supervisor: **Alberto Colorni Vitale**

Customer reviews in E-commerce are playing an important and unique role; a staggering 90 percent of people use and monitor reviews in their online purchasing process [10]. However, the overwhelming number of reviews and inconsistent writing style require significant effort to read and tend to let important information slip by. Given that people examine the attributes of a product to evaluate whether the product fits their desire, a number of systems have summarized customer reviews by extracting features and associating sentiment toward each feature. Liu *et al.* (2005) [5] and Carenini *et al.* (2009) [2] used bar charts to show the sentiment of summarized features. Carenini *et al.* (2006) [1] summarized user reviews in the form of a Tree map by representing a feature as a rectangle with nested rectangles corresponding to the descendants of the feature. In addition to numerical ratings, Yatani (2011) [9] used adjective-noun word pairs to summarize the sentiment (adjective) towards each feature (noun) to help users explore reviews in greater detail. In most conditions of online shopping, online purchasing can be viewed as a decision-making process from the perspective of the customer [3]. In light of human decision-making theory, we learn that the same decision

maker appears to selectively adopt information and use a wide variety of strategies contingent on decision properties [7]. In general, an effective information display depends on two matches: on the one hand, the match between the importance of information for the decision maker and the salience of the information display [6] and, on the other hand, the congruence between the information format and the way information is processed [8]. Hence, the foundation of designing information displays for user decision improvement is gaining a deep understanding of human decision-making behavior. Some researchers investigated how people use online rating to make choices. For example, Lelis S. and Howes A. (2011) suggested that people gather more information for the best alternative and take more time to inspect reviews of lower rating [4]. However, no clear picture exists to systematically describe how consumers make purchase decisions in E-commerce, in particular, with respect to customer reviews. In this paper, we take online hotel booking as an example to empirically investigate consumer decision-making behavior in three stages of online purchasing: (1) screening out interesting alternative(s) for further consideration, (2)

evaluating alternatives in detail, and (3) comparing candidates to make the final choice. Interfaces that aggregate information from customer reviews have been developed to support the three alternative stages. Through analysis of the results, we identify the decision strategies users utilize to process information and the information they are inclined to seek at each stage. These findings lay solid groundwork to design E-commerce interfaces for consumer decision improvement. Concerning user decision-making behavior in the stage of screening out interesting alternatives, we find that: (1) 94% of participants began by eliminating alternatives with values for an attribute below a cut-off to simplify the complexity of the choice; (2) 55.3% of participants eliminated alternatives by both static features (i.e., product specifications) and customer reviews. Moreover, the number of users who adopted opinion attributes (i.e., attributes extracted from customer reviews) is significantly higher than that using an overall review score; and (3) the cut-off values are determined by the value distribution of an attribute and correlation among attributes, in addition to stable preference. Grounded in these user decision-making behaviors, we framed two alternative designs for an opinion-attribute-

embedded filter panel based on checkboxes and sliders. In the checkbox interface, the filter for each attribute is represented in the form of an array of N checkboxes, which is utilized in most E-commerce websites. In the slider interface, the filter for each numerical attribute (i.e., price and opinion attributes) is represented by a modified slider, which visualizes the distribution of an attribute via bars and the correlation among attributes via simultaneous change. Then, we performed a user study to compare the two alternative designs in the context of online hotel booking. The results show that people depended highly on opinion attributes to narrow down the range of options in both interfaces, which points to the effectiveness of incorporating opinion attributes in filters. And the slider interface achieves significantly higher user assessments in terms of perceived decision accuracy, cognitive effort, pleasantness to use and intention to return. After narrowing down options to a smaller set, 40% of participants adopted a more compensatory strategy – Weighted Additive Difference, i.e., comparing the remaining alternatives on multiple attributes and selecting the alternative with the best overall value. More notably, significantly more participants compared alternatives by opinion attributes in comparison with those associated with an overall review score. Therefore, we developed a multi-attribute sorting panel embedded with opinion attributes. Furthermore, the multi-attribute sorting panel was expanded to three alternative designs that mainly differ in the way of eliciting

relative importance for attributes: (1) direct assessment, asking users to directly assign weights to attributes; (2) indifference method, modifying one of two sets of stimuli until subjects feel that there is no difference between the two; and (3) indirect measurement, giving relative preference on a pair of alternatives. Through analysis of objective and subjective measures, the multi-attribute sorting was verified to be beneficial to consumer online purchasing. The direct way outperforms the indifference and indirect ways regarding perceived decision accuracy, cognitive effort, satisfaction and intent to use in an E-commerce environment. Informed by the results of the above user studies, we have derived a set of guidelines on how to design interfaces for consumer purchase decision improvement in E-commerce.

## Reference

1. Carenini G., Ng R.T., and Pauls A. Interactive multimedia summaries of evaluative Interfaces text. In *Proceedings of the 11th International Conference on Intelligent User interfaces (IUI '06)*, pp. 124–131, 2006. ACM.
2. Carenini G. and Rizoli L. A multimedia interface for facilitating comparisons of opinions. In *Proceedings of the 14th International Conference on Intelligent User Interfaces (IUI '09)*, pp. 325–334, 2009. ACM.
3. Chen L. Towards Three-Stage Recommender Support for Online Consumers: Implications from a User Study. *Web Information Systems Engineering – WISE 2010*, 6488: 365–375, 2010.
4. Lelis S. and Howes A. Informing decisions: how people use online rating information to make choices. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems CHI '11*, pp. 2285–2294. 2011. ACM.
5. Liu B., Hu M., and Cheng J. Opinion observer: analyzing and comparing opinions on the Web. In *Proceedings of the 14th International Conference on World Wide Web*, pp. 342–351, 2005. ACM.
6. MacGregor D. and Slovic P. Graphical representation of judgmental information. *Journal of Human-Computer Interaction*, 2 (3): 179–200, 1986.
7. Payne J. W. Task complexity and contingent processing in decision making: an information search and protocol analysis. *Organizational Behavior and Human Performance*, 16 (2): 366–387, 1976.
8. Todd P. and Benbasat I. The influence of decision aids on choice strategies: An experimental analysis of the role of cognitive effort. *Organizational Behavior and Human Decision Processes*, 60 (1): 36–74, October 1994.
9. Yatani K., Novati M., Trusty A., and Truong K.N. Review spotlight: a user interface for summarizing user-generated reviews using adjective-noun word pairs. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems CHI '11*, pp. 1541–1550, 2011. ACM.
10. <https://moderncomment.com/customer-feedback-stats>