



SENSES & SENSIBILITY 2019  
**LOST IN**  
**(G)LOCALIZATION**

| November 27th to 29th  
| Lisbon, Portugal



UNIDCOM|IADE



Faculdade de Design,  
Tecnologia e Comunicação  
Universidade Europeia



Fundação  
para a Ciência  
e a Tecnologia





**SENSES & SENSIBILITY '19**  
LOST IN (G)LOCALIZATION

# **SENSES & SENSIBILITY'19: LOST IN (G)LOCALIZATION**

## **COLLECTION**

Proceedings book of UNIDCOM/IADE Conferences

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27-29 November 2019, Lisbon, Portugal**

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# Keynote Speakers

## RACHEL COOPER

PhD, FRSA, FDRS, OBE  
Lancaster University, UK

Rachel Cooper OBE is Distinguished Professor of Design Management and Policy at Lancaster University. She was founding Director of Imagination Lancaster. Her research interests cover: design thinking; design management; design policy; and across all sectors of industry, a specific interest in design for wellbeing and socially responsible design. She has published extensively on these topics, including books 'The Handbook of Design Management', 'Designing Sustainable Cities', 'The Handbook of Wellbeing and the Environment' and 'Living in Digital Worlds; designing the digital public space'. She is also series editor of the Routledge series Design for Social Responsibility. She is a member of the Council of The Royal College of Art and Norwich University of the Arts. She is advisor to a number of government and non-government initiatives, she was a Lead Expert for the UK Government Foresight programme on the Future of Cities, the Blackett Review of the Internet of Things and the Academy of Medical Sciences Working group addressing 'the health of the public 2040'. She is now on the Expert Steering Group for the UK Partnership for Prevention Research and a UK representative on the ICSU Scientific Committee for Health and Wellbeing in the Changing Urban Environment. She was founding editor of The Design Journal and also founding President of the European Academy of Design. She is currently President of the Design Research Society.



## THE POWER OF DESIGN

Lisbon, 27th of November 2019

Designers must go beyond design; this presentation will illustrate this, by reflecting on how design has changed and through the design research undertaken at ImaginationLancaster. How do we influence and answer questions on; who makes design decisions, how we inform design decisions, how we engage with design decision-making, and how we help design futures. Finally, how do we educate the next generation of design leaders.

# Keynote Speakers

## BRUCE BROWN

PhD, The Royal College of Art, London  
Goldsmiths University of London, UK

Bruce Brown was educated at the Royal College of Art in London. Until, 2016 he was Professor of Design at the University of Brighton and Pro-Vice-Chancellor Research. For twenty years previously he was Dean of the university's Faculty of Arts & Architecture. He was appointed by the UK Funding Councils to chair a Main Panel in the last national Research Excellence Framework (REF 2014) — overseeing the quality assessment of all arts and humanities research in UK universities. Currently he is chair of the Creative Arts panel for the Hong Kong Research Assessment Exercise 2020. Previously he chaired the Portuguese Government's Fundação para a Ciência e a Tecnologia Research Grants Panel [Arts] and was one of four people invited by the Portuguese Government to conduct an international review entitled Reforming Arts and Culture Higher Education in Portugal. Recently he chaired the accreditation and validation of University PhD programmes in Estonia and Israel and is a Board member of EQ-Arts which supports arts institutions throughout Europe. He has served as Trustee and Governor of organizations such as the Crafts Council and the Art's Council for England's South East Arts Board. He is an Editor of Design Issues Research Journal (MIT) and a Visiting Professor at the Royal College of Art, London, and at Goldsmiths University of London. He lectures regularly on design at international venues.



## EXPERIENCE DESIGN

Lisbon, 28th of November 2019

Design is both a young profession and a part of the human psyche. Only human beings can reshape the natural world and enhance their own biology through design. Now we design systems of artificial intelligence and mass communication that allow others to condition how we experience the world and make decisions. If we are to defend free will in a democratic society then a new approach is needed that sheds the 20th century model of design in which people are just one of design's objects — a new approach in which design no longer works on human behavior but with human experience. This will stimulate new forms of production and consumption in which artifacts and images remain indispensable to the human experience.

# Keynote Speakers

## LUÍS ROCHA

Public Affairs & Market Access Director  
Novartis

Public Affairs & Market Access Director at Novartis Portugal since 2007, Board Member of the Novartis Executive Committee (Novartis, Sandoz, Alcon) since 2006. Heads the Public Affairs (institutional relations, communication and medicines policy) and Market Access activities (registration, financing and reimbursement, health economics & outcomes research). Member of Novartis European Public Affairs team, Novartis European Health Economics and outcomes research and Market Access teams. Has a work record of over 25 years in Pharmaceutical and Information Technology industries, spanning across different business areas at UNISYS (IT & information systems), Merck Sharp & Dohme (1988-2002), Pfizer (2002-2006) and Novartis (2006-now). Degree in Business Administration, executive training in General Management (INSEAD, 2005) and Healthcare management (NOVA, 2007), a post-graduation on Health Economics (ISEG, 1995), and supplemental training in Strategic Planning, Marketing, Public affairs and Health Economics and Health Policy (Harvard Health Systems Excellence, 2018). Areas of interest include Health financing and, Health targets, Science communication, Health literacy, Evidence based medicine, Big data in healthcare. Born in Évora, Portugal, lives in Lisbon. Enjoys travelling, technology, music (classic & contemporary), photography, bird watching. Married with Sofia (MD), has 2 kids currently in University: Vera (Management degree at NOVA University of Business and Economics) and Ivo (MD student at Nova Medical School).



## HEALTHCARE: GLOBAL CHALLENGES TO LOCAL SOLUTIONS DESIGN

Lisbon, 28th of November 2019

# Keynote Speakers

## PAUL HEKKERT

PhD, Delft University of Technology,  
The Netherlands

Dr. Paul Hekkert is full professor of form theory and head of the Design Aesthetics group at the school of Industrial Design Engineering, Delft University of Technology. Paul conducts research on the ways products impact human experience and behaviour. He published articles dealing with product experience and aesthetics in major international journals, and is co-editor of *Design and Emotion: The experience of everyday things* (2004) and *Product experience* (2008). In 2011 he received a VICI grant from the Dutch Science foundation (NWO) to develop a Unified Model of Aesthetics (UMA). Together with Matthijs van Dijk, he published *Vision in Design: A guidebook for innovators* (2011), a book that describes an approach to design and innovation that has been widely applied in both education and industry. More recently, Paul co-authored *Designing for Society: Products and Services for a Better World* (2019, with Nynke Tromp). Paul serves as a member of the editorial boards of *The Design Journal*, *Empirical Studies of the Arts*, and the *International Journal of Design*. Paul is also member of the Dutch Creative Council and captain of science of the Top Sector Creative Industries. His current research interest concentrates on the role of design in major social transformations in such diverse areas as energy use, sustainability, mobility, or health care. Paul firmly believes that designers have a range of special skills (e.g. imagination), capabilities (e.g. reframing) and methods (e.g. ViP) that make them perfectly suitable to lead such transformation processes. His research interest thus revolves around areas such as social design, social innovation, system design, and value-driven design.



## DESIGN FOR IMPACT: CONSIDERING THE VARIOUS WAYS IN WHICH DESIGN CAN HAVE AN IMPACT ON WELL-BEING AND SOCIETY AT LARGE

Lisbon, 29th of November 2019

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## Design for Education

*A significant challenge for design education is making impactful connections with wider societal and organizational issues while incorporating cross-disciplinary knowledge, and at the same time remaining pertinent and relevant to local concerns. This track would like to explore ways of fostering the connections between design education, practice and research aiming to better understand the relation between local and global within the educational context. Research at both the macro and micro levels, as well as the bridges between them, are welcome.*

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# The teaching of information design for a multidimensional exploration of natural and cultural heritage contributing to the preservation of its memory and global existence



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## Abstract

Information design is a fundamental area in access to knowledge and its main interest focuses on the dynamics of interaction between people and information. Among the various possibilities of expression of its practice, infographics stands out as one that attempts to make information accessible and usable by all, in order to accelerate understanding and memorization of messages that are transmitted. Infographics gives preference to visual language, making complex data structures easily understandable. This study aimed to integrate the practice of infographics in interpretation and presentation of cultural and natural heritage, through an Infographics course unit of the bachelor's degree program of Multimedia, Education and Communication in Polytechnic Institute of Beja. Through a literature review, a visual research of infographic cases applied to heritage, and a compilation and observation of various practical results obtained by students' works, it was sought to answer how teaching of information design and infographics can contribute to the interpretation, presentation and preservation of natural and cultural heritage of a region, highlighting its own and specific characteristics, through a multidimensional exploration and contributing to its (g)localization. It was found that the use of visual information proves to be very effective in presenting information that is complex, such as the information on the heritage. The heritage's presentation should visually stimulate, communicate information and provoke reflection while maintaining historical rigor and respecting heritage's integrity, expanding its historical memory, and contributing to its conservation for future generations.

## Keywords:

**Information Design, Infographics, Information Design's Teaching, Cultural and Natural Heritage**

## 1. INTRODUCTION

Information design is characterized by its interdisciplinary approach, crossing several areas of knowledge to produce, transmit and interpret information in different communication contexts. This study intends to establish an interconnection between information design and heritage areas and to reflect on important aspects through the presentation of practical examples that prove the necessary approach between these two study fields. The first one (information design) can work on and transform information; the second one (heritage) can contribute significant information to work with.

Therefore, it was tried to integrate the practice of infographics in interpretation and presentation of cultural and natural heritage, through an Infographics course unit of the bachelor's degree program of Multimedia, Education and Communication (MEC), in Polytechnic Institute of Beja (IPBeja) located in region of "Baixo Alentejo", south of Portugal. In this study, some of the students' works developed during eleven academic years (2007- 2008 / 2018-2019) for the main project of the course unit will be presented. In addition, some exercises related to this theme were also tested within the scope of another course unit (Multimedia Laboratory I - MLI) of the bachelor's degree program of Arts and Multimedia, of the same institution.

Through a literature review on the theme, visual research of infographics cases applied to heritage, and a compilation and observation of best solutions performed during the mentioned academic years, it was sought to answer the research question: can the teaching of information design and the result of its practice, infographics, contribute to interpretation, presentation, and preservation of the natural and cultural heritage of a region, highlighting its own and specific characteristics, through a

multidimensional exploration and contributing to its (g)localization?

The objectives established for this study were:

- a) to reinforce the importance of an Infographics course unit in bachelor's degree programs directed to education, communication and design;
- b) to transmit knowledge and information through an essentially visual language;
- c) to highlight the role of information design in interpretation, presentation and preservation of heritage;
- d) to raise awareness of specific heritage aspects that are less known, demonstrating the need for their mediatization;
- e) to present the most relevant results obtained in the referred eleven academic years;
- f) to create an archive of illustrations and three-dimensional models of the worked heritage elements, contributing to their digital preservation.

The main objectives and teaching methodologies of the course unit will be presented and subsequently, the most relevant results will be made available. Finally, the most significant conclusions of the practical results will be highlighted.

## 2. UNDERSTANDING INFORMATION DESIGN: ESSENTIAL ISSUES FOR ITS GOOD PRACTICE AND TEACHING

Information design is the area that studies the practices of visual information presentation, and infographics is one of the possible results of the application of these practices.

Horn (Horn, 2000) defines information design as the art and the science of preparing information



to be used by humans in an effective and efficient way. Lankow, Ritchie and Crooks (Ritchie et al., 2012, p. 20) refer to information design as “the practice of representing information in a visual format”. Regarding infographics, Meirelles (Meirelles, 2013) states that it is one of the possible results from the great discipline of information design, composed of visual presentations, in which graphs (illustrations, symbols, maps, diagrams, etc.) associated with verbal language communicate information that otherwise would not be possible to be communicated. *Infographics* is an abbreviation of information graphic and is connoted with presentations characterized by illustrations, large format typography, as well as long and vertical orientation, displaying a variety of facts and presented in different formats (Ritchie et al., 2012).

The role of information design is to turn chaos into order, and information into meanings and wisdom by helping people gain knowledge. At a time when we are constantly surrounded by information and messages, all wanting to get our attention, the way information is organized, written, and presented is extremely important so that we can all understand it (Baer & Vacarra, 2008) (Spiekermann, 2002). Information design helps to explain and understand the phenomena of the invisible world and it results in a work of translating the real world through visual means or, more precisely, graphics (to visualize or to schematize are ways of enlarging the perceivable world) (Costa, 1998; Costa, 2011; Hansen, 2000). An information designer presents himself as a “transformer” who gives meaning to raw data, as well as organization and consequently informative value to a more general audience, contributing to a greater memorization and knowledge. Through visual information, we detect patterns and relationships and our long-term memory is triggered - we have a greater ability to memorize the information we get through images compared

to only text (Costa, 2011; Krum, 2014; Serra, 2014; Ware, 2012). Thus, the design process depends on cognitive processes and visual perception for both its creation (codification) and its use (decoding). Information designers need to be aware of these issues so that they can organize and structure, emphasize and hierarchize information (Baer & Vacarra, 2008; Cairo, 2013; Pettersson, 2012; Shedroff, 2000; Wildbur & Burke, 1998; Wurman et al., 2001). When creating functional images, we must always take into account basic and primary visual representation graphic elements that influence our perception of shape (Costa, 2011; Pettersson, 2012). An information designer has communication of information as his/her main task and this implies the responsibility for the content to be both accurate and impartial in its presentation (Wildbur & Burke, 1998); this professional must be very rigorous in the search and communication of information, while attempting to present it in a visually effective way and always paying attention to its target audience (Baer & Vacarra, 2008) (Cairo, 2013) (Coates & Ellison, 2014). An information designer should also practice methodological procedures that contribute to a clear and reliable communication of information, as well as have a conscious knowledge of the different stages involving the creation of an infographics.

Those working in this area must think of structure first and only then of style, building a *solid skeleton* for information, a reading path, an order, a hierarchy, and a narrative. They should know how to control abstraction or iconicity according to the main objectives of the infographics and according to target audience and how they will perceive and relate to information (Cairo, 2013). An information designer should pay attention to elements such as color (Coates & Ellison, 2014; Gibson, 2009; Glaser et al., 2011; Tufte, 1990) and typography (Cairo, 2013; Coates & Ellison, 2014; Frascara, 2015; Heskett, 2002; Kinross, 1985; Typographic Design in the Digital Domain with

Erik Spiekermann & Elliot Jay Stocks, 2011), or concepts such as readability, legibility or contrast (Coates & Ellison, 2014; Lidwell et al., 2003), often taking advantage of a macro or micro organization (Glaser et al., 2011; Tufte, 1990), having the purpose of infographics always in mind. The designer should be aware of the functional, technical and aesthetic principles of information design (Pettersson, 2012) and use visual features such as illustrations, 3D models, photographs or pictograms and icons, which will enrich visual information, motivating the reader to see information and most importantly, to want to know more about a particular subject (Ritchie et al.; Krum, 2014; Coates & Ellison, 2014; Abdullah & Hübner, 2006).

According to Bonsiepe (Bonsiepe, 1999), all these questions are fundamental to the practice of information design and, consequently, should be transmitted in its teaching. The information designer structures and organizes information and provides guidance so that the user finds his way in the information maze. The author also says that this change presupposes cognitive and organizational skills that are sometimes neglected in design education. This point of view is shared by Sless (Sless, 1992) who reinforces the idea by saying that there is a big difference in terms of objectives between information design and traditional graphic design. Costa (Costa, 2011) argues that in order to launch an information design project, a designer must have a logical attitude and a great capacity of abstraction, organizing information so that its receptor turns it into useful knowledge. It is essential to have a logical, schematic and very programmatic mindset, but which in no way will exclude the creative imagination. Frascara (Frascara, 2015) states that information design is not defined by what it is done, but by how it is done and how it responds to people's needs with regard to the understanding and using of products, services and facilities; the author further states

that information design should be based on interdisciplinary knowledge and founded on ergonomics, linguistics, psychology, sociology, anthropology, graphic design and informatics - among other fields. Finally, the author reinforces this idea by quoting the International Institute for Information Design (IIID): Good information design makes information accessible (easily available), appropriate (to its contents and users), attractive (tempting), concise (clear and without effects), relevant (linked to the user's purpose), timely (available when the user needs it), understandable (no doubt or ambiguity), appreciated (for its usefulness) and usable. Information design is also affirmed by its application to various knowledge areas for disseminating information in a visual and more understandable way.

### 3. VISUAL INFORMATION IN THE PRESENTATION OF HERITAGE

According to ICOMOS (International Cultural Tourism Charter, 1999), the intrinsic characteristics of natural and cultural heritage have different levels of significance (some have universal value, some national, regional or local value). Accordingly, interpretation programs must take into account these different levels of meaning and present them in a clear and accessible way to host communities and visitors. To this end, interpretation programs should use the most stimulating means of teaching, including audiovisual and technological means, as well as personalized explanations of historical, environmental and cultural aspects, so that they can ensure the long-term preservation of the natural and cultural heritage by contributing to important public awareness. According to Fernández and Ramos (Fernández & Ramos, 2002), cultural heritage of a country, region or city is constituted by all those tangible or intangible

elements and manifestations produced by societies, the result of a historical process where the reproduction of ideas and material constitute factors that identify and differentiate a country or a region. Hernández et al. (J. B. Hernández & Tresserras, 2007) state that interpretation facilitates the presentation and social use of heritage and offers different readings and options for active use of heritage. The goal is to boost heritage in its original context, starting from natural and cultural resources, tangible or intangible, through interpretation. This delivers keys to a heritage reading that provides visitors with a meaning and an experience. Alves (Alves, 2014) states that the reasons and motivations of tourists for choosing a place to travel are influenced by its symbols and signs and by the constant coming and going of tourism; symbolic exchanges are processed through colors, shapes, habits, smells, and techniques. According to Ramos et al. (Ramos et al., 2010), the mental image created in relation to the destination to be visited is part of the motivation that leads the individual to travel to that place. They also state that the image of the tourist destination can be defined as an amalgam of impressions, thoughts, imaginations, emotions, knowledge, and concepts developed by the individual(s) through a process of perception about a certain locality or tourist destination. The image of the tourist destination is important because it affects the subjective perception of the individual and, consequently, his/her behavior and the choice of destination. Alves (Alves, 2014) highlights the need to consider the existence of the place's soul, and points to an interaction of people who have feelings for their place of experience, demonstrating that there is soul when there is passion of people for the place. Hernández et al. (J. B. Hernández & Tresserras, 2007) reinforce that the presentation of heritage has to fulfill a series of premises for a visitor to have a quality cultural experience. This presentation will have to include dissemination

of speech to different audience sectors, through attractive communication and the use of new technologies and audiovisual languages to communicate complex processes. The same authors state that a heritage's presentation should include publications that make various levels of information available to the public. These may include, for example, leaflets with general information, suitable maps, and infographics to facilitate visitor orientation, well-illustrated pocket guides, textbooks and games for children and parents, monographs on specific content, and expert guides for teachers. It is important to consider design strategies for the heritage's presentation to all audiences. Interpretation is based on the need to segment audiences and offer services, sensations and heritage readings adapted to different needs. Since it is often impossible to present the entire heritage to the public, clear criteria must be taken into account when choosing the place, bearing in mind conservation degree, historical, artistic and scientific interest, as well as cultural significance. An integral project that simultaneously contemplates research, conservation and presentation must then be elaborated (F. H. Hernández, 2002). Hernández states that new technologies have given rise to enormous possibilities in heritage diffusion by allowing the incorporation of texts, images and sounds that offer a more effective reading of information. Thus, heritage presentation must be attractive and visually stimulating as well as provoke reflection, while maintaining historical rigor and respecting heritage integrity (F. H. Hernández, 2002; Silvan, 1997).

#### **4. NEW TECHNOLOGICAL APPROACHES TO HERITAGE – THE USE OF 3D TECHNOLOGY**

The need to understand our history and our heritage value leads us to look for new tools that offer clearer information and information closer to reality. Heritage representation is extremely important as it is a source of knowledge and support for all conservation, presentation/information and dissemination processes (Balcázar, 2015). Presentation and preservation of tangible and intangible heritage are now significantly improved through the use of information and communication technologies (ICT) such as computer graphics and multimedia. Applications that are made available to the public range from virtual presentations of objects that no longer exist or important archaeological remains, to games designed for heritage interpretation, as well as virtual museums. Physical museums are increasingly combined with digital content according to age and interest of the target audience. Today there are various ways to mediatize heritage using new technologies (Rizvic, 2014). Infographics, for example, has become a way through which we can understand the heritage and approach reality. Infographics allows us to rescue and value a heritage's tangible and intangible cultural wealth through design and visual elements, such as colors and textures (Balcázar, 2015). When we talk about new technologies, we also talk about new ways of communicating heritage and how exploiting modern technological advances can impact the restoration, preservation, and electronic documentation of any kind of cultural heritage (M. Ioannides, 2010). The growing use of digital 3D modeling in the cultural heritage field is becoming increasingly important and a very effective and intuitive mean of communication (Manferdini & Remondino, 2010). According to the same authors, in recent years, the use of 3D technology has caused a fundamental change in our cognitive model - the availability of digital 3D replicas, compared to the usual photos, videos or drawings, allows us to communicate

more effectively on scenes or objects that have intrinsic three-dimensional characteristics. This kind of representation has changed the way we access and exchange knowledge, expanding our possibilities for interpreting and analyzing the past, and helping to simulate reality more objectively and reliably.

## **5. INFOGRAPHICS COURSE UNIT OF THE BACHELOR'S DEGREE PROGRAM OF MULTIMEDIA, EDUCATION AND COMMUNICATION (MEC), IPBEJA**

The Infographics course unit begins on the 1st semester of the 3rd year of the bachelor's degree program of MEC in IPBeja institution. The course unit's evaluation consists of: (i) two introductory exercises (one of contextualization of infographics in a news and social communication, and another exercise with the realization of a pictograms family); and (ii) a main project contextualized in the presentation of heritage (with different stages of development and with the realization of a static and a multimedia infographics and their integration in a communicational material). Along eleven academic years (2007/2008 to 2018/2019), an infographics portfolio consisting of the best heritage infographics examples produced by students was created. The portfolio focused on the representation and appreciation of local specificities of selected regions, with special emphasis on the Baixo Alentejo region. It was assumed that students had some communication and visual language bases, and consequently, it was expected that students could communicate visually at a more complex level, but in a way that was accessible and understandable to the general public. The methodology of the work process was established in a work document

made available to students and which will be presented in a summarized way. The main objective was to produce infographics at the level of its main visual elements (illustrations or 3D models), aiming to its integration in a final layout, static or dynamic, interactive or non-interactive, while trying to motivate a possible audience to acquire knowledge about a certain heritage theme. The final aim was to respond to current communication needs and encourage students to think visually for communicating any informational content, with the ultimate goal being the understanding and memorization of the message by the general public.

### 5.1 MAIN OBJECTIVES OF THE COURSE UNIT

The course unit had the following objectives:

- a) To know the concepts associated with information design field, its history and its different applications;
- b) To contextualize infographics practice among the various possible applications in the information design area;
- c) To encourage research habits on performing infographics, highlighting the importance of the information's accuracy when presented and communicated;
- d) To understand and identify functional, aesthetic, cognitive and perceptive principles of information design and infographics practice;
- e) To consolidate basic concepts of visual representation and develop complex visual models based on illustration, photography or 3D modeling;
- f) To interpret visible and invisible phenomena through visual representation - to know how "to schematize" reality;
- g) To apply the methodology to the practice of an infographics project for the transmission of an informative message in a visual way;
- h) To differentiate technical aspects associated

with print or digital contexts (online);

- i) To articulate all constituent elements (verbal and nonverbal) in an infographic project;
- j) To highlight the role of information design and infographics in interpretation, presentation, and preservation of heritage.

### 5.2 PROJECT DESCRIPTION

The project aimed to perform an infographic (static and multimedia) for a specific region of Portugal, representative of its cultural and natural heritage. In most of the years, the district of Beja was highlighted for the development of infographics, always giving students the possibility for choosing heritage cases from where they lived. It is important to mention that in one academic year (2017/2018), it was proposed that work was conducted on the municipality of Aljezur, Faro district, Algarve region (south of Portugal). The following work guidelines were given: natural heritage (beaches, nature parks, fauna or flora species); tangible cultural heritage (castles, churches, museums, galleries, traditional architecture); intangible cultural heritage - crafts, arts (handicraft, traditional music), oral history, gastronomy (aromas, berries and infusions, wines and spirits, regional dishes, regional products), legends, customs (festivals, fairs) or history. This study will only refer to infographics developed in static format, presented in the end of the course unit on an A2-size panel, in rigid support.

### 5.3 THE METHODOLOGY APPLIED TO THE COURSE UNIT AND TO THE DEVELOPMENT OF THE INFOGRAPHICS PROJECT

In this section, the methodology applied to the classes and teaching of the infographics course unit will be presented. Then, the main steps required for the development of static infographics by students will be explained. Thus, the classes were planned as follows:



a) Expository and experimental classes for apprehension of taught concepts (theoretical-practical);

a1) Development of practical work in laboratory environment as a way to deepen knowledge, to develop technical, creative and conceptual skills, and consolidate competences (some exercises were developed only in a classroom context, in order to instill in the student the ability to visually represent in a short period of time);

a2) Exhibition of theoretical contents fundamental to the practice of information design;

a3) Visualization of several reference examples to enrich the visual culture in the area;

b) Provision of recommended literary references;

c) Presentation and discussion of developed work (group discussion and visualization);

d) Project practice as a way to obtain knowledge (Gray & Malins, 2004) - in the classroom context and autonomously.

Concerning item a3, it is important to note that several reference examples of infographics applied to heritage presentation were presented in class context and compiled over the years in a website named INFO-ARCHIVES (Info-Archives, n.d.) by the author of this paper. This kind of digital archive was performed to systematically organize data and essential information about the collected examples. The visualization of several reference examples was part of a teaching strategy meant to increase students' visual culture and potentiate their better understanding of some fundamentals of information design in the presentation of heritage.

Finally, the development of infographics was based on the methodology suggested by Cairo

(Cairo, 2013). Thus, several evolutionary stages were considered, which were followed by the author of this paper throughout the classes. The steps considered were as follows:

1- to define the focus of the infographics, like the story/information to be told and the key points to be realized; to clarify the idea of how the infographic will be useful to readers and what they can do with it;

2- to gather as much information as possible on the topic being worked on (research phase); to do interviews if necessary, to search for data sets and to write or to define storyboards for ideas in a sketched way;

3- to choose the best graphic style. What shapes should the data take? What kind of graphics, maps, and diagrams better fit the objectives defined in the first stage? What illustrations should be done?

4- to complete the research; to improve sketches and storyboards;

5- to think about visual style; to choose typographic fonts, color palettes, etc.;

6- to transpose all the sketches into the computer; to complete the layout and all the elements using the appropriate software tools.

#### 5.4 RESULTS

Next, a selection will be presented with six completed infographics subsequent from the project developed in the infographics unit course. In Fig. 1 and 2 (on the left side), we can see two examples representing intangible cultural heritage, in Fig. 3, two examples representing tangible cultural heritage, in Fig. 2 (on the right side), an example representing natural heritage, and finally, in Fig. 4, an example that refers at the same time, cultural and natural heritage. This selection was made to cover the several typologies of heritage, taking into account the relevance of the themes and

the successful application of the information design fundamentals taught in class, according to the essential issues for good practices of information design described in item 2 of this paper. Besides, these examples were chosen for the way they present the visual information and the complexity represented on the main visual elements, either through two-dimensional digital illustration or three-dimensional modeling. In all of them, we can see the use of other auxiliary visual representation systems, that were used to communicate information in a more accessible way, such as graphs, tables, pictograms, maps, or photographs. Emphasis strategies such as

different colors and tones, hierarchy, and visual organization between the various elements presented, differences of scale, framing, and positioning, were applied too. Visual elements such as lines, pure geometric figures to delimit areas, and guide the user's gaze when reading information were also used for greater efficiency in communication and to increase legibility and readability. In all the projects, students gave special relevance to the stages of research and layout planning (through sketches and analog wireframes), which proved to be fundamental for successful completion of the work.

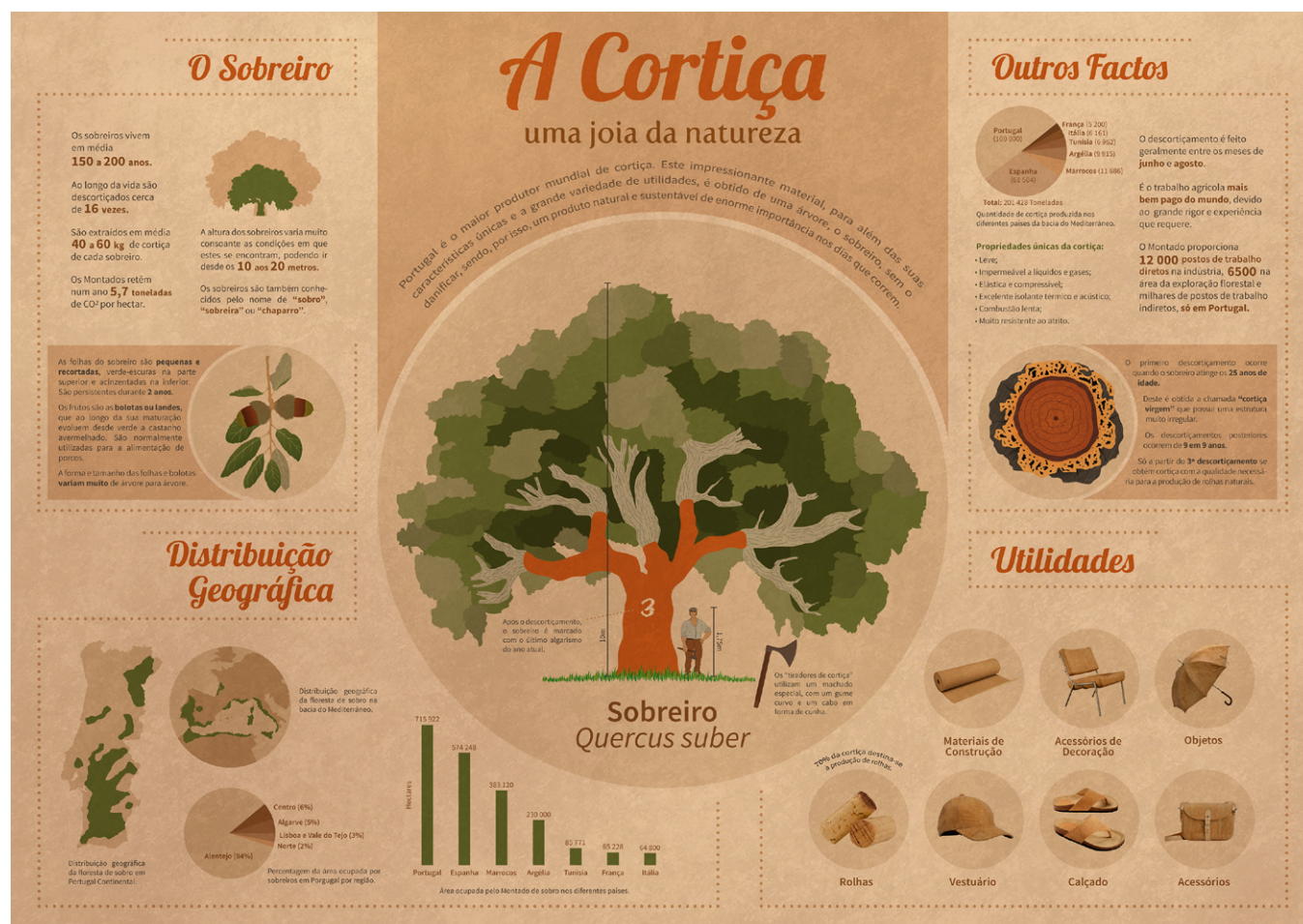


Fig. 1. The Cork, Vitor Gregório, Academic Year 2013/2014. Infographic representing Intangible Cultural Heritage.

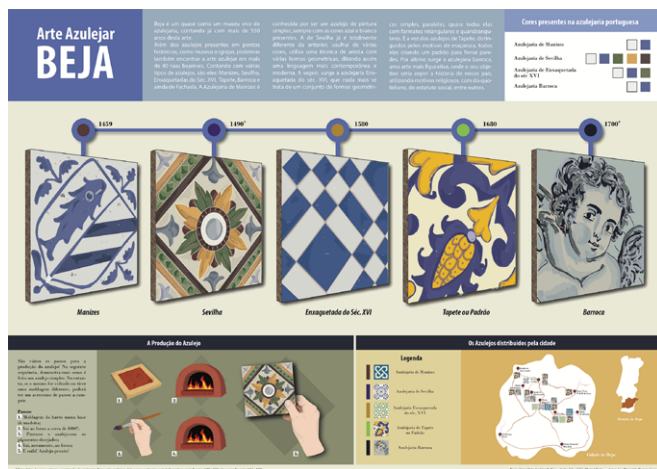


Fig. 2. Tile Art of Beja, Ana Costa, Academic Year 2018/2019 (left). Infographic representing Intangible Cultural Heritage. Hoopoe, Guadiana Valley Nature Park, Beja, João Ferreira, Academic Year 2011/2012 (right). Infographic representing Natural Heritage.

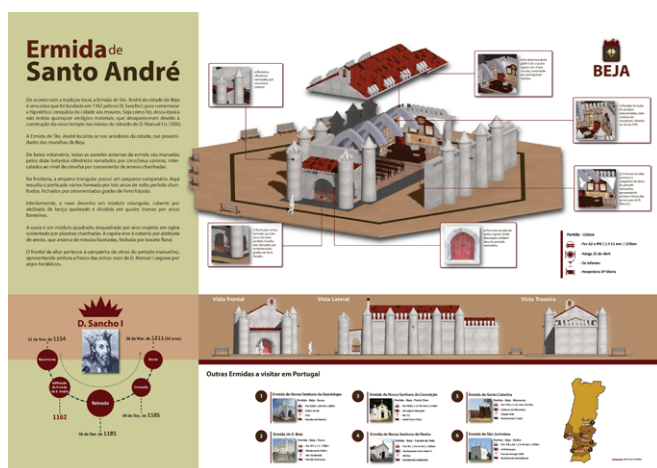
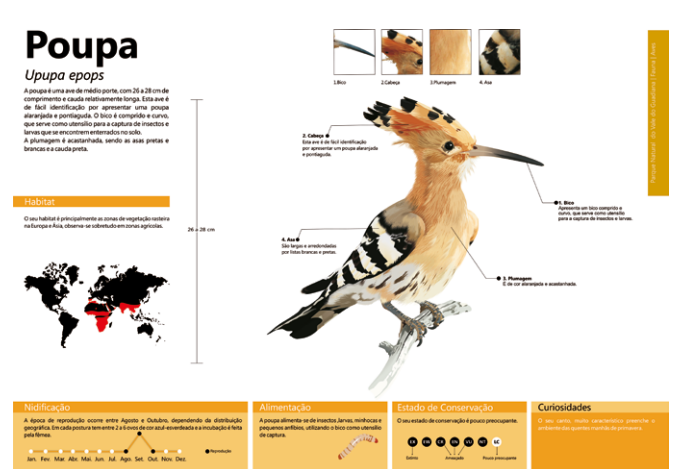


Fig. 3. Chapel of Santo André, Beja, Luís Pires, Academic Year 2014/2015 (left). Aljezur Castle, Faro, Leonor Nobre Academic Year 2014/2015 (right). Infographics representing Tangible Cultural Heritage.



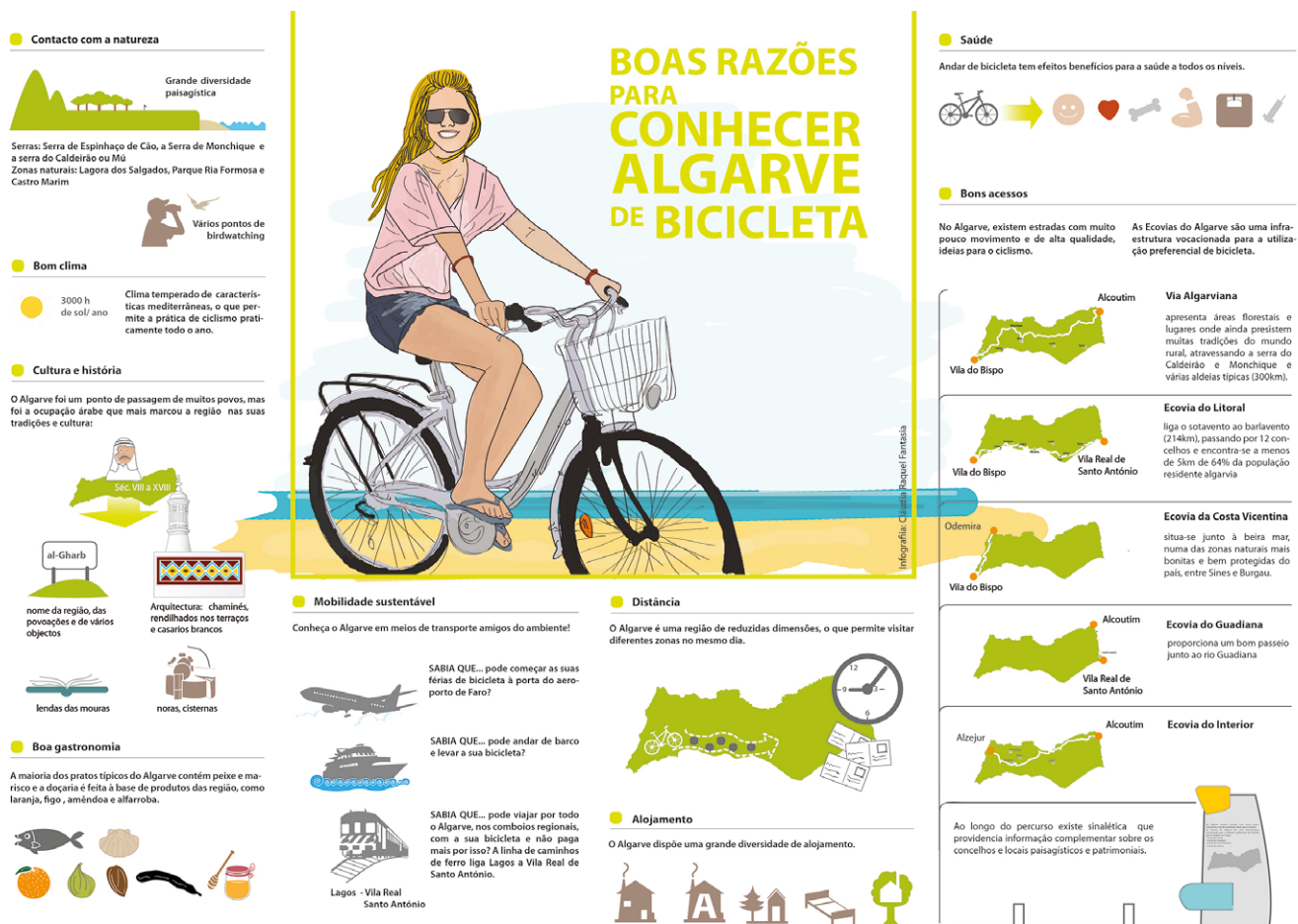


Fig. 4. Good reasons to visit Algarve by bike, Cláudia Fava, Academic Year 2011/2012 (left). General infographic that alludes to all heritage categories.

The works presented are a small sample of all projects developed during the mentioned academic years. The methodology for performing infographics consisted of the students' development of complex visual elements through bidimensional illustrations or three-dimensional representations. This allowed more effective communication of the scenes or heritage objects and their associated information. It was found that most information would not have been possible to be presented without it being in a visual and *infographic* mode. There was often few information available on work topics, as

some heritage sites are still little explored or mediatized and are less known, which made the making of infographics difficult. A structured and rigorous research, as well as a respect for the information to be communicated were always values transmitted to students. The act of turning raw data into easily understandable infographics about unique heritage aspects was the objective of the course unit. This was achieved through practical work done in classroom context, accompanied directly by the teacher and according to the principles of information design. Gaining knowledge and skills through practice

were part of the outlined methodology, the objective being for students to learn how to solve real problems according to available information on heritage sites, which oftentimes can be too little. Project structuring in several phases, all with the teacher's feedback, allowed students to refine their work and achieve higher quality in the final results. A variety of platforms and means for visualizing (visual) information should be taken into account by students, including certain technical specifications, which were conveyed through project requirements. In addition, students were also asked to develop a multimedia version of the static one, exploring its possible multidimensionality.

through bidimensional or three-dimensional representations, integrated into infographics, will contribute to the preservation of its memory and also, to an existence that goes beyond geographical limitations, contributing to global access anywhere in the world. Thus, it is believed that the results presented will enhance the role of information design in the dissemination of heritage. Finally, the outcomes of this educational project succeeded in linking the teaching and practice of infographics, in solving real information problems in the presentation and interpretation of heritage, and in contributing to its future preservation in a digital environment.

## 6. FINAL REMARKS

Overall, the selection of works done by students (a small part of the works developed in the course unit), literature review, and visual research carried out, show that the interaction between information design and heritage is very pertinent. The intrinsic characteristics of information design's practice and its application to the field of heritage, where information (complex, most of the time) has to be presented in a rigorous, clear and motivating way for a successful presentation and dissemination, justify this combination. Some infographics representing heritage can be true repositories of data, derived from a research-based methodology, with great informational and artistic value, attracting us for their beauty and making us want to know more about the information presented. The work performed on local and less well-known or mediatized aspects is also important, as it gives added value to the academic project carried out. In the future, the infographics developed can be integrated into contexts that seek to value the worked regions and make them accessible. The existence of heritage elements in a digital environment,

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# PoliTO Sustainable Campus: An Interdisciplinary Design Education Experience

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## Abstract

Education has an essential role in teaching people to understand, manage and change their environment. Higher Education Institutions play a crucial role in the education of future generations, in the development of scientific research which has to be able to meet societal goals and in the dissemination of knowledge inside society, also concerning the capacity of fostering sustainable development. On this basis, the contribution aims to bring to light the experience developed within the framework of a university educational path, the Young Talent Programme project. It involved 236 students from different subject areas (from design to engineering, from architecture to urban planning), who have reasoned around six themes closely related to the theme of sustainability: transport and sustainable mobility, renewable resources and energy production, building and energy efficiency, food, water and waste. What we want to show in the contribution is how the cross-fertilization that can occur in a polytechnical context could be useful for the development of a more complex and full project, and how the discipline of design can become a tool not only for the design of new products, services or communications but also a fundamental tool to mediate the knowledge involved, integrating the different skills and increasing the effects.

## Keywords:

**Sustainability, Interdisciplinary Design, Design Method.**

# 1. EDUCATION FOR SUSTAINABLE DEVELOPMENT

## 1.1 AGENDA 2030 AND SUSTAINABLE DEVELOPMENT GOALS

On 25 September 2015, the United Nations approved the Global Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs), divided into 169 targets and over 240 indicators to be achieved by 2030 (United Nations, n.d.).

On this historic occasion, a clear judgement was expressed on the unsustainability of the current development model. In this way, and this is the highly innovative character of Agenda 2030, the idea that sustainability is only an environmental issue is definitively overcome, and an integrated vision of the different dimensions of development is affirmed, not only on the environmental level but also on the economic and social levels.

Indeed, one of the innovative principles of the Agenda is the integrated view of the dimensions of sustainability and the recognition of synergies among the goals (Giovannini, 2018).

The SDGs were designed as a continuum of the Millennium Development Goals (MDGs), eight goals that in 2000 all UN member states pledged to achieve by 2015. Since their adoption, essential goals have been reached, but the goals set have not been fully realized.

The SDGs present a more ambitious agenda, as they seek to eradicate poverty rather than reduce it, and include more demanding targets on health, education and gender equality. They are also more complex and comprehensive because they include new issues such as climate change, sustainable consumption, innovation in all fields and the importance of ensuring peace and justice for all (see Fig. 1).



Fig. 1. Sustainable Development Goals (United Nations, 2015)



## 1.2 GOAL 4: QUALITY EDUCATION

Education has an essential role in teaching people to understand, manage and change their environment. Some research points out that the educational system is sometimes not able to adequately meet this need (Ward, 1990). Because of the failure of education in the relationship between humans and the environment and communication, children today cannot understand the outside world and they cannot establish healthy relationships with the physical environment. Education for sustainability, therefore, has an important role and the mission to fill this gap.

Higher education institutions play a crucial role in the education of future generations, in the development of scientific research which has to be able to meet societal goals and in the dissemination of knowledge inside society, also concerning the capacity of fostering sustainable development, defined as the “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”, according to the Brundland Report (*Report of the World Commission on Environment and Development: Our Common Future*, 1987). In this context, education for sustainable development is explicitly recognized in target 4.7 of Agenda 2030., among the characteristics of goal 4: quality education. It reads: “4.7 by 2030 ensure all learners acquire knowledge and skills needed to promote sustainable development, including among others through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural diversity and of culture’s contribution to sustainable development.”

To paraphrase this target, in order to contribute to the creation of a more sustainable world,

individuals have to become agents of change, equipping themselves with knowledge, skills, values and attitudes that enable them to make informed decisions and act responsibly for environmental integrity, economic sustainability and a fairer society for present and future generations. Education is therefore crucial for achieving sustainable development and at the same time sustainability, in its social, environmental and economic meanings, has become a fundamental prerequisite at all stages of the design process (Tamborrini, 2009). This can be seen with even greater emphasis when dealing with issues relating to mobility and transport, energy and waste management, resource consumption and everything related to the world of food and nutrition.

## 1.3 THE ROLE OF GREEN OFFICE

In this context, Green Offices, laboratories and teams within universities and research centres that bring together students, researchers and lecturers with the aim of coordinating initiatives and projects with a strong social and environmental impact, are becoming increasingly important.

Their increasing popularity, following the first Dutch experience in 2010, shows that universities are increasingly oriented towards research, training and the development of active citizenship (Cucchiara, 2018). However, such activities should not and cannot be relegated to a few but draw their strength in the involvement of different disciplines and people with different roles, from student to professor, from technical staff to administration. It is the people who live every day in contact with a situation, the best to involve in the design. And who better than the students themselves who live and inhabit the campuses daily to know their needs, desiderata and languages?

From this necessity was born the collaboration



with the Young Talent Programme project by the Green team (*PoliTo Sustainable Campus* - Home, n.d.) of the Politecnico di Torino, born in 2015.

## 2. YOUNG TALENT PROGRAMME PROJECT

The Young Talent Programme project was launched in 2014 by the Politecnico di Torino with CRT Foundation.

The course involves each year 240 best students from the areas of engineering, architecture, territorial planning and design. Students follow a personalized training path and are granted a fee reduction, a student pass for public transport and a museum pass. The Green Team coordinates the Young Talent Programme project started in the academic year 2018/2019 using a project-problem-based approach where involved actors work together and share ideas in different forms (seminars, workshops, case studies, visits) to address the complexity of wicked problems. Objectives of the project are twofold: on the educational side to propose an experiment of student's involvement in real-life processes while on the research side to create a new kind of support to the decision-makers of the Sustainable Path project.

In the first semester, students of architecture were involved in the Ecological Footprint course. Groups of students collaborate with different volunteering associations in order to assess not only the environmental impact of their actions but also the social and economic ones.

In the second semester, students were divided into groups corresponding to different areas of sustainability of a university campus. In this course, each group analyzed more in detail the complex system of sustainability inside a university campus and developed new strategies with the support of the Green Team members and external actors.

### 2.1 PARTICIPANTS

For the 2018/2019 academic year, the Young Talent Programme project involved 236 students from different polytechnic areas such as engineering, architecture, urban planning and design. As can be seen from Table 1, the disciplines do not cover the entire offer of the University itself (in fact, there are no students from the chemical engineering field), and there is a strong imbalance towards the engineering disciplines, which cover 85% of the total. All students were then divided, following their own choices, into the six themes closely related to the theme of sustainability: transport and sustainable mobility, renewable resources and energy production, building and energy efficiency, food, water, and waste.

Area	Discipline	Students
Architecture & Design	Architecture	18
Architecture & Design	Design & Communication	13
Architecture & Design	Territorial, urban, environmental and landscape planning	3
Engineering	Aerospace engineering	38
Engineering	Automotive engineering	8
Engineering	Biomedical engineering	12
Engineering	Cinema and media engineering	2
Engineering	Computer engineering	37
Engineering	Electrical engineering	1
Engineering	Electrical and communications engineering	3
Engineering	Electronical engineering	17
Engineering	Energy engineering	7
Engineering	Management engineering	7
Engineering	Mathematics for engineering	22
Engineering	Material engineering	2
Engineering	Mechanical engineering	23
Engineering	Physical engineering	23

Table 1. Students and disciplines involved in the Young Talent Programme project.

Concerning the workshops that will be analyzed in this contribution, and therefore the workshop related to the theme of food and the one related to the theme of waste, both involved 34 students, with a respective percentage of 17% and 12% of the component related to the area of Architecture and Design. The students coming from the engineering disciplines are instead well distributed, revealing the first result of differentiation of interests that does not only refer to the course of study undertaken.

### 3. THE ROLE OF DESIGN

As mentioned before, the disciplines involved different from each other. However, from a design-oriented perspective, we can see how all these can generate a system, to define the relationship between possible and achievable. The discipline of design has always been influenced by the active transitions that take place in the context, as well as by the whole field of material culture, economy, society and more widely of culture and history. As Celaschi (Celaschi, 2008) argues, a design-driven approach does not only consider this discipline, but we notice how it intersects with other disciplines such as art, technology, economics and the humanities, managing the balance between them (see Fig. 2). Design thus takes on cultural value and becomes a tool for enhancing skills, a mediator and integrator of knowledge, a mediator between needs, a tool for tracing new routes in innovation, a methodological tool for exploring new sectors, a tool for approaching complexity, a tool for reading social, territorial and productive changes, a tool for guiding a society of networks, sharing and sustainability (Buchanan, 2001).

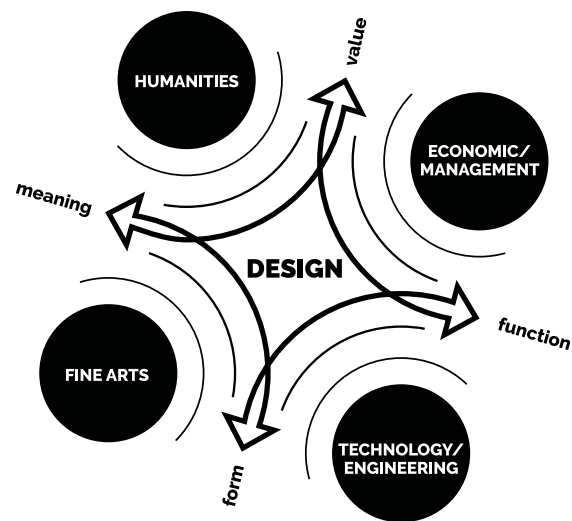


Fig. 2. Areas of approach to design that direct meta-design research (Celaschi, 2008)

At the same time, however, design is the discipline able to guide towards change by influencing the choices and development of new products and services (Buchanan, 2001). Trying to make a comparison with the Krebs Cycle, Oxman (Oxman, 2016) comes to define a Krebs Cycle of Creativity (KCC) (see Fig. 3). In this reasoning, we see how the creative energy and the project can be described in their perpetuation as a biological relationship of mutual exchange. The four modalities of human creativity (science, engineering, design and arts) replace the carbon cycle taking place according to their characteristics and roles in the project. Indeed, as Oxman writes: “The role of Science is to explain and predict the world around us; it ‘converts’ information into knowledge. The role of Engineering is to apply scientific knowledge to the development of solutions for practical problems; it ‘converts’ knowledge into utility.

The role of Design is to produce embodiments of solutions that maximize function and augment human experience; it 'converts' utility into behaviour. The role of Art is to question human behaviour and create awareness of the world around us; it 'converts' behaviour into new perceptions of information, re-presenting the data that initiated the KCC in Science" (Oxman, 2016).

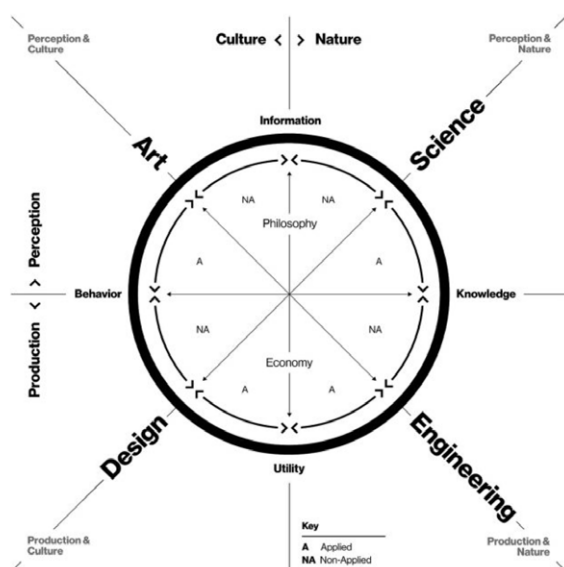


Fig. 3. Krebs Cycle of Creativity (Oxman, 2016)

This shows that knowledge can no longer be found and relegated only within its disciplinary boundaries. It, therefore, becomes fundamental to interweave different areas that necessarily define new fields of action and new potential. In doing so, design can offer itself as a tool through which new worldviews can be developed; a means that must necessarily be integrated with the requirements of extemporaneous society (Scalera, 2015). It becomes connective, able to produce innovative solutions thanks to the connection between people, objects, nature, technologies and production capacities.

## 4. DESIGN-DRIVEN TEAMS' EXPERIENCES

"Learning is the process whereby knowledge is created through the transformation of experience". This is what educator David Kolb (Kolb, 1984) stated in 1984, developing an experiential learning model, called Kolb cycle. According to the most recent neurobiological studies our brain acquires concepts, notions and relationships much faster if it is pushed to put them into practice itself. Physical and emotional involvement, therefore, facilitates attention and memory.

The contribution will specifically illustrate the workshops that have covered the issues of food and waste, which have seen involvement of the discipline of design as regards both students, teachers and assistants to the laboratory. Starting from field analysis and direct experiences with the topic, be it food or waste, students had the opportunity to highlight critical issues and potential, arriving at the development of design concepts ranging from communication strategies, viral videos and forms of gamification, to new services and new ways of using spaces to improve life on campus, better understand the resources used daily, inform and disseminate good sustainable practices.

### 4.1 MENS SANA: PROJECTS AROUND FOOD<sup>1</sup>

Starting from the exploration of the food matter, the module has set itself the objective of understanding, analysing, developing and experimenting with some decisive and sustainable scenarios for the university. Students had the opportunity to think about the

<sup>1</sup> "Mens sana: projects around food" involved Paolo Tamborini, Cristian Campagnaro, Sara Ceraolo, Raffaele Passaro, Nicolò Di Prima, Silvia Favaro, Debora Fino, Alessia Toldo.

food topic through the contribution of different actors that intertwine different knowledge involving, in addition to the discipline of design, also sociology, anthropology and chemistry. The visit to the FICO Eataly World food park in Bologna and the experience with the Food Design Lab of the Department of Architecture and Design of the Politecnico di Torino (see Fig. 4), gave students new points to think about, starting from the knowledge of production processes to the transformation of the product itself. The results showed very different concepts, but all proposed starting from a careful investigation of what happens inside the university and the needs and wishes of the people who live and frequent the campus daily. We then move from reasoning starting from the food waste, to proposals related to the space dedicated to the lunch activity.



Fig. 4. Experience class with Foodesign Lab

#### 4.2 WASTE, MEDIA, POLICIES & UNIVERSITY SOCIETIES <sup>2</sup>

Starting from the analysis of the relationship between waste, university campus and sustainability, the module has worked on the development and testing of some fictional scenarios useful to raise awareness in the university community in the implementation of

good practices of disposal.

The immediate focus was on the analysis of communication related to the issue of waste, starting from the investigation of the practices adopted within the universities, to the exploration of techniques useful to analyze texts, articles and content present on social media. All with the aim also to learn about the differences between news and fake news. This competence is becoming increasingly important nowadays, given a large number of sources and communication tools at our service.

The visit to the waste-to-energy plant of the City of Turin and the collaboration with the Turin start-up Quaerys offered students useful tools to approach the topic from different points of view. The concepts developed by the students see a predilection for the world of communication, leveraging the possibility to inform and educate subjects in the implementation of good practices. Videos designed for social media (see Fig. 5) as well as prototypes of mobile applications strongly characterized by gamification elements, try to propose new ways to address the issue of waste and easily involve even more people.

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<sup>2</sup> “Waste, media, policies & university societies” involved Debora Fino, Giuseppe Tipaldo, Fabio Bruno, Nicola Miraglio, Barbara Stabellini, Paolo Tamborrini.

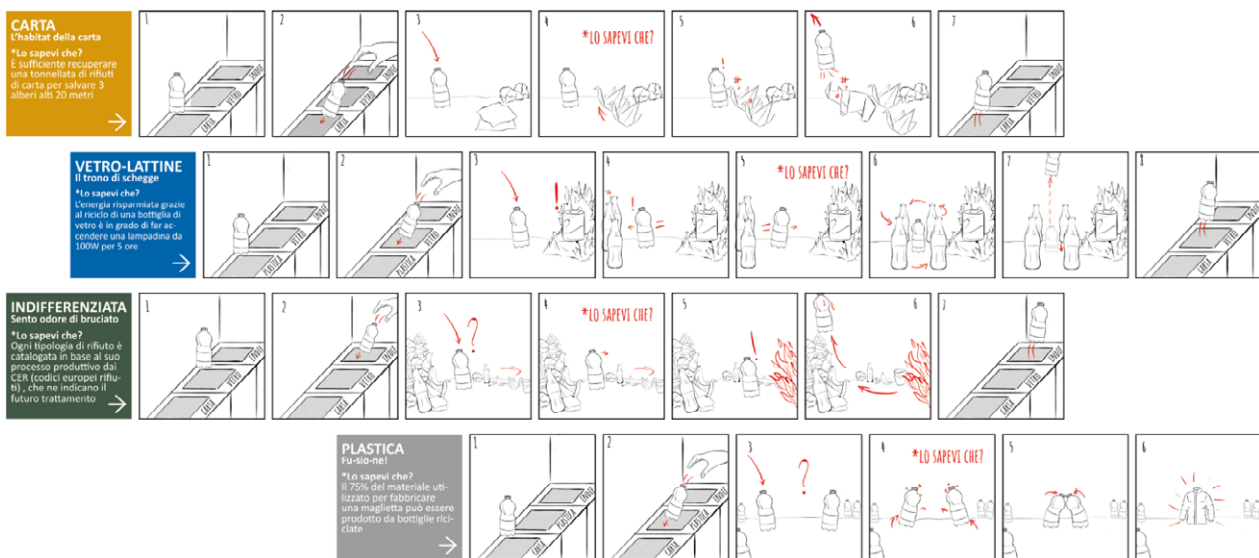


Fig. 5. Storyboard of communication videos on topic waste

## 5. CONCLUSION AND FUTURE WORK

These results were possible only thanks to the cross-fertilization that was created within the laboratories involved, where different disciplines have each found their own space of action offering the skills in which each is an expert, but according to a more design-oriented approach. An approach that is increasingly spreading even to disciplines far from design, more scientific and engineering.

What we want to show in the contribution is how the cross-fertilization that can occur in a polytechnical context could be useful for the development of more complex and full projects. We also want to focus on how the discipline of design can become a tool not only for the design of new products, services or communications but also a fundamental tool to mediate the knowledge involved, integrating the different skills and increasing the effects.

The results confirm how didactics can also be delivered in ways that go beyond traditional frontal lessons, considering experiential learning

dynamics and other innovative forms such as flipped classrooms, problem-setting/solving activities and multidisciplinary group design. The projects of all six workshops were exhibited in the framework of the Circonomia event, an event on the themes of the circular economy held on 4 and 5 June 2019 and included in the schedule of the Festival of Sustainable Development. During this event the results have been evaluated by the students through the expression of a preference each and the result has determined the first position for the workshop “Mens Sana: projects around food”, and the second position for the workshop “Waste, media, policies & university societies”, demonstrating how a design process and a more communicative result can bring together issues sometimes of little interest or distant from the topics of the discipline of study. Satisfied with the results obtained, the same methods will be repeated this year, where, however, the focus on Agenda 2030 will be even greater as the issues will no longer arise from the topics of interest of the University Green Team, but will specifically concern the 17 Sustainable Development Goals, with the aim of developing concepts and proposals in the short term to achieve the goal set.



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# Micro influence of Learning Outcomes in Basic Design

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## Abstract

Learning Outcomes (LOs) are increasingly emphasized in Higher Education (HE) systems all over the world as supporting globalization when considered at the macro scale of influence. Facing the urgent revision towards education automation, this study addresses the LOs micro-scale of influence. It can add to the setting of a solid background for innovative approaches to learning Basic Design (BD) that include, but are not limited to, digital-based tools. Therefore, we specifically aim for the identification of: i) the main components involved in each LO (i.e., levels of knowledge and content topics) as defined in the constructive alignment theory; and ii) the prominent combinations of levels of knowledge and content topics used in the Portuguese BD courses. We applied a qualitative approach, which included the use of MaxQDA software for the content analysis of the LOs from a set of Portuguese BD courses. The results revealed: i) two detailed conceptual matrixes of the levels of knowledge and content topics found in the LOs; and ii) the combinations, highlighted by frequency and importance, performed by the students in Portuguese BD courses. We acknowledge that content topics related to personal values, skills and design fundamentals are common in both frequency and importance. This micro-scale analysis opens the opportunity for the creation of BD learning experiences focused on addressing significant LOs, especially if aligned with programmes outcomes and graduate attributes. Also, other courses in the design field and other associated areas can benefit from conducting such a micro-scale analysis.

## Keywords:

Portuguese Design Education, Basic Design, Learning Outcomes, Virtual Reality.

## 1. INTRODUCTION

Within a culture of human-technological mutual shaping (Kaplan, 2009), the evolution of design education and, consequently, Basic Design (BD), is being (im)posed by technological migration. A non-returnable movement towards education automation, as anticipated by Fuller (1964), is in constant acceleration, just reinforced by the recent urgency of new digital solutions to face quality distance learning all over the world. In this sense, we see here not only an opportunity for the emergence of innovative educational solutions from a broad perspective but, in particular, for BD.

This study takes part in a larger project that aims to develop a Virtual Reality (VR) based tool for teaching-learning BD, for which it will contribute. However, the work reaches far beyond the area of influence of any technological, analogue or digital medium, as it addresses the gap of knowledge about the LOs present at many of the existent BD courses.

With this study, we specifically aim the identification of a conceptual frame present at the Portuguese BD courses, considered both dimensions of the LOs (i.e., levels of knowledge and content topics) as defined in the constructive alignment theory. This subject was earlier addressed by us in Neves, Dias, Duarte and Ramalho (2019), which provided the basis for achieving a second objective – the definition of the prominent combinations between levels of knowledge and content topics used in the Portuguese BD courses.

### 1.1 LEARNING OUTCOMES

LOs can be considered descriptions of abilities expected from learners as a result of learning experiences. They are also identified as: academic goals; expected results; and learning objectives.

A set of knowledge, skills, and competencies are embodied in the LOs, which also include values, beliefs, and attitudes to be achieved by students (Dias, 2017). From the point of view of the student, LOs are intentions to act on a specific object and are, thereby, identified as Intended Learning Outcomes (ILOs) (Biggs & Tang, 2007). Three levels of ILOs need to be aligned: graduate attributes; programme outcomes; and course outcomes.

The impact of the Bologna Declaration on the Higher Education (HE) system established learning outcomes as a key instrument (OECD, 2012), that becomes a familiar and relevant expression among all the actors in the system. Next to and aligned with assessment methodologies and curricula design, LOs constitute the “Framework for Qualification of European Higher Education”. This European common structure allows the comparison between study programmes and HE institutions in Europe. The several qualification levels of the Framework are defined according to a learning outcomes approach (González & Wagennar, 2008).

It is emphasized the importance of the LOs for directing the design of learning activities by focusing on the required changes on the learners’ performance; in establishing guidelines for content, instruction and evaluation; in explicitly recognizing what is to be learned; and in delivering to learners what exactly is to be accomplished. The constructive alignment theory was created by Biggs (Biggs & Tang, 2007) and is based on the constructivist theory of learning. It is known for addressing the enhancement of teaching and learning that focus the outcomes, often referenced as outcomes-based teaching and learning (OBTL). The design of learning activities, in constructive alignment, ensures the presence of the intended verb in the outcome



statement in the teaching/learning activity and the assessment task. They are the key to the whole system. The desired outcomes of teaching specify the performance that students should achieve in terms of the level of understanding a certain content topic. SOLO taxonomy uses a list of appropriate verbs in two main categories: quantitative and qualitative, respectively corresponding the low level and high level. A pre-structural level precedes all the levels and it stands for non-existing competences. It is mostly used in the evaluation phase of the learning process. The low-level outcomes involve simple and quantifiable verbs. They are considered uni-structural level (e.g., identify; memorize; and doing simple procedures) and multi-structural level (e.g., enumerate, describe, list). As for the quality phase, the high-level outcomes are subdivided in relational level (e.g., compare/contrast; explain causes; analyse; apply) and extended abstract level (e.g., crating; theorizing; reflecting; grounding). There are appropriate levels for each level taught and, in the case of HE system, intended outcomes would be predominantly high level (Biggs & Tang, 2007). We intend to verify this idea in the context of the Portuguese BD courses by using the micro-scale analysis on its LOs.

## 1.2 BASIC DESIGN

The original 1919 Basic Design course, the preliminary, later called basic course, was considered as one of the main pillars of the Bauhaus Design School (1919-1933) (Bonsiepe, 2012) and, in the opinion of Cross (1983), Bauhaus' most important educational innovation. According to its creator, Johannes Itten (1888-1967), the course aimed for the students to: access inner experiences, perceptions and creative forces that would liberate them from preconceptions enabling confidence in free expression and creation; discover personal unique

characteristics by experimenting with different materials/mediums, thereby, easing their choice of career; and finally, be aware of the principles of form and colour in composition for applying them in articulation both in objective and subjective modes Itten (1975).

After one century, BD is internationally consolidated as an introductory course to the design principles, targeting first-year undergraduates in design. Nationally, recent studies identified it's permanence in the Portuguese HE system (Neves, Dias & Duarte, 2018) and revealed the presence and evolution of BD over fifty years of the design study programmes at IADE design school (Neves, Duarte & Dias, 2018).

## 2. METHODOLOGY

In this study, we adopted a qualitative approach to determine the most frequent combinations in the two dimensions of the LOs (i.e., levels of knowledge and content topics). The MaxQDA software was used for the content analysis of the Portuguese BD courses study plans.

### 2.1 SAMPLE

Forty-three study plans, from the on-going Portuguese design study programmes, were identified as carrying the BD tradition, presented by different terms (e.g., Introduction to Design; Design Fundamentals; Design I; and Basic Design Project). These BD study plans, classified according to the economic sector, HE system and type of design study programme, are presented in Figure 1. For the latter, we used the categorization from the Portuguese professional classification (Agapito et. Al, 2015) plus DG - General Design, introduced by us.

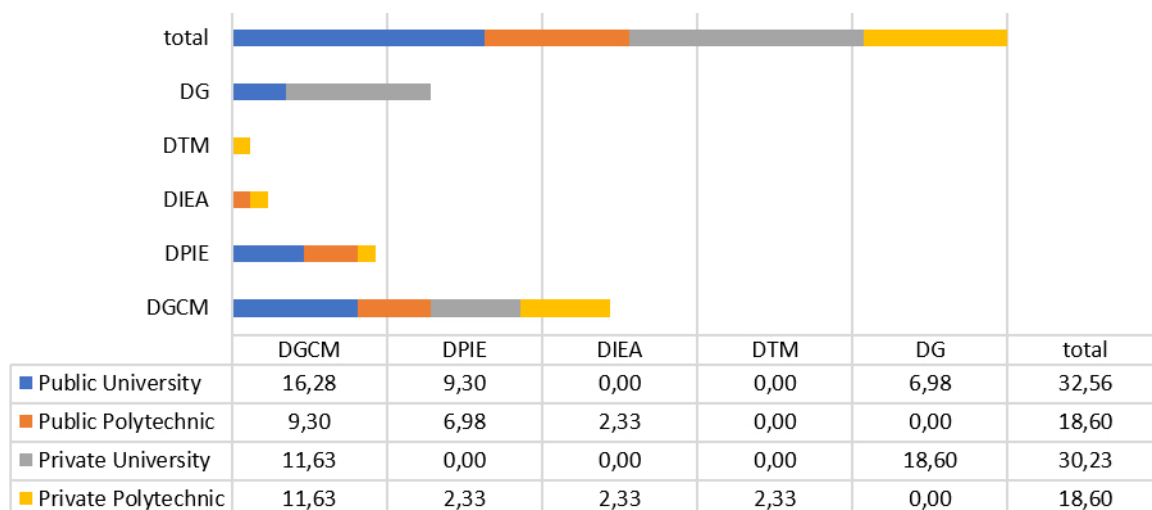


Fig. 1. Basic design courses in Portuguese design study programmes (%).

Legend: DPIE - Industrial, Product or Equipment Design; DTM - Textile or Fashion Design; DIEA - Interiors, Space or Environment Design; DGCM - Graphics, Communication and/or Multimedia Design; DG - General Design.

## 2.2 INSTRUMENTS

We analysed the sample using the lexical-conceptual matrixes previously created by Neves et al. (2019), which was improved for the present microanalysis. Sublevels were added from the first and second hierarchical levels. The conceptual matrixes of levels of knowledge and content topics are presented in Table 1 and Table 2, respectively. The matrix that refers to the levels of knowledge: low(1)-uni-structural; low(2)-multi-structural; high(3)-relational; high(4)-extended abstract; and undefined, use the same expressions derived from the constructive alignment theory plus the numeric code (n), for this analysis. The undefined level was created by us for associating all the verbs considered

ambiguous or doubtful and that could not be classified. As pointed earlier, the pre-structural level stands for non-existing competence, thereby presenting no verb associated to that level. For that reason, we considered it inadequate for use in this specific analysis. The content topics expression follows the same criteria and thereby, a code composed by letter and numbers (X)1.1. reference is used next to the several categories (e.g., (A)communication; (B)design fundamentals; (C)means and techniques; (D)personal values and skills; (E)historical, economic, social, cultural context; (F)project-methodology; and (G) undefined).

Table 1. Levels of knowledge matrix.

<b>low(1)-unistructural</b> (1)1_sensitize (1)2_define (1)3_identify (1)4_represent;draw;operate; exercise (1)5_awake; introduce (1)6_recognize	<b>high(3)-relational</b> (3)1_manage (3)2_express (3)3_synthesize (3)4_project (3)5_interpret (3)6_explain; justify (3)7_integrate;merge; articulate (3)8_criticize;judge;decide (3)9_organize (3)10_plan (3)11_build up (3)12_solve problems (3)13_analyze (3)14_defend; argue (3)15_apply	<b>high(4)-extended abstract</b> (4)1_gain autonomy (4)2_strictly master (4)3_transform (4)4_reflect (4)5_create new concepts (4)6_substantiate (4)7_design (4)8_create; compose
<b>low(2)-multistructural</b> (2)1_experiment; explore (2)2_acquire habits (2)3_systematize (2)4_differentiate; structure (2)5_describe; communicate (2)6_present results		<b>Undefined level</b> (0)1_understand; to know (0)2_develop (0)3_vague (0)4_no content

Table 2. Content topics matrix.

<b>(A)communication</b> (A)1_general communication (A)2_visual communication (A)3_concepts (A)4_perception (A)5_representation; expression	<b>(D)means and techniques</b> (D)1_analogical (D)1.1_general means and tech. (D)1.2_painting (D)1.3_mockups (D)1.4_typhography (D)1.5_drawing (D)1.6_modeling (D)1.7_handcraft (D)1.8_plastic/graphic expression (D)1.9_prototype; model (D)1.10_photography (D)1.11_paintingmaterials (D)2_analogical-digital
<b>(B)design fundamentals</b> (B)1_color (B)1.1_general color (B)1.2_elements (B)1.3_composition; structure (B)1.4_function (B)1.5_theory (B)2_shape (B)2.1_general shape (B)2.2_3D shape (B)2.3_2D shape (B)2.4_theory (B)2.5_function (B)2.6_composition; structure (B)2.7_relations (B)2.8_elements (B)3_fusion fundamentals (B)3.1_theory (B)3.2_function (B)3.3_composition; structure (B)3.4_relations	<b>(E)personal values and skills</b> (E)1_work process (E)1.1_team work (E)2_communicate (E)3_self-knowledge; self-critique (E)4_interdisciplinarity; multidisciplinary (E)5_autonomy (E)6_learn (E)7_critique (E)8_analisis; reflection (E)9_observation; to see (E)10_creativity; curiosity (E)11_delivery term
<b>(C)project</b> (C)1_project; methodology; product	<b>(F)contexts (historical; economic; social; cultural)</b> <b>(G)undefined content</b>

## 2.3 PROCEDURE

For the qualitative analysis, we used the units of text previously coded, from the Portuguese BD study plans and categorized according to the conceptual matrixes (i.e., levels of knowledge and content topics) (Neves, Dias, Duarte & Ramalho, 2019).

The connections between the two matrixes of the LOs were accessed using two procedures: (i) in the case of the sublevels, by selecting the codes and using the combine function in MaxQDA; and (ii) using excel files as they allow more flexible search by using simultaneous filters. Then, charts/graphics (see Figure 2) were created for assisting the comprehension of the results.

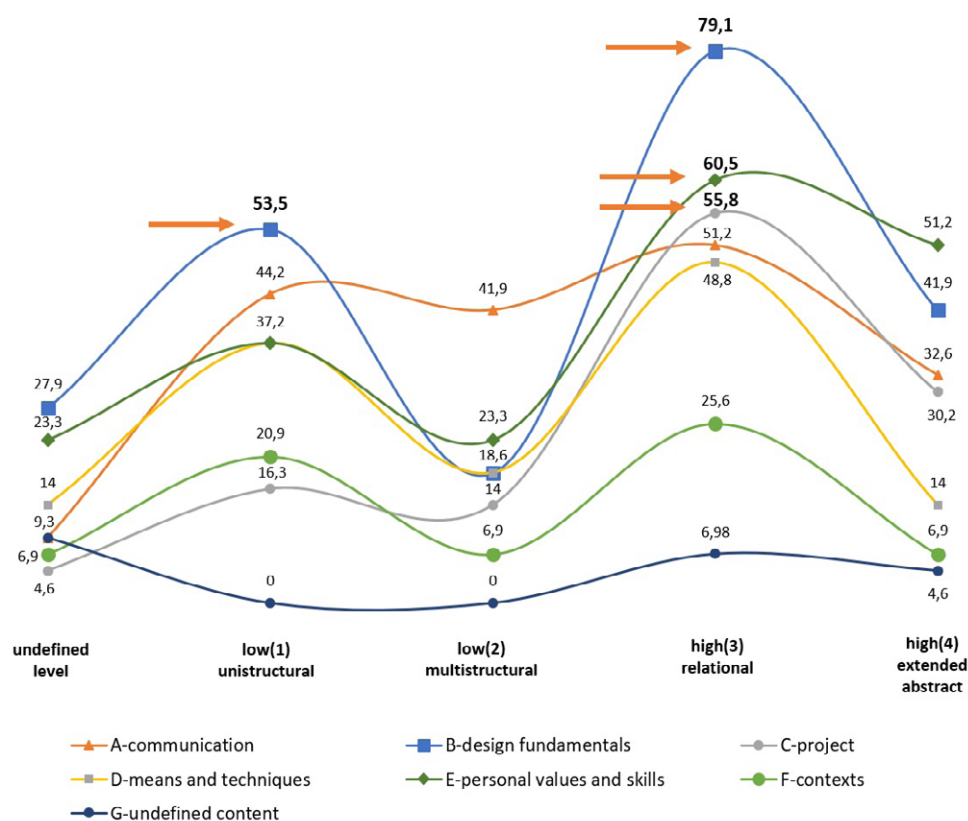


Fig. 2. Frequency of connections between levels of knowledge and content topics (%).

The Figures 3 and 4 address the high(3)-relational and low(1)-uni-structural sublevels, pointed as the most frequent levels of knowledge.

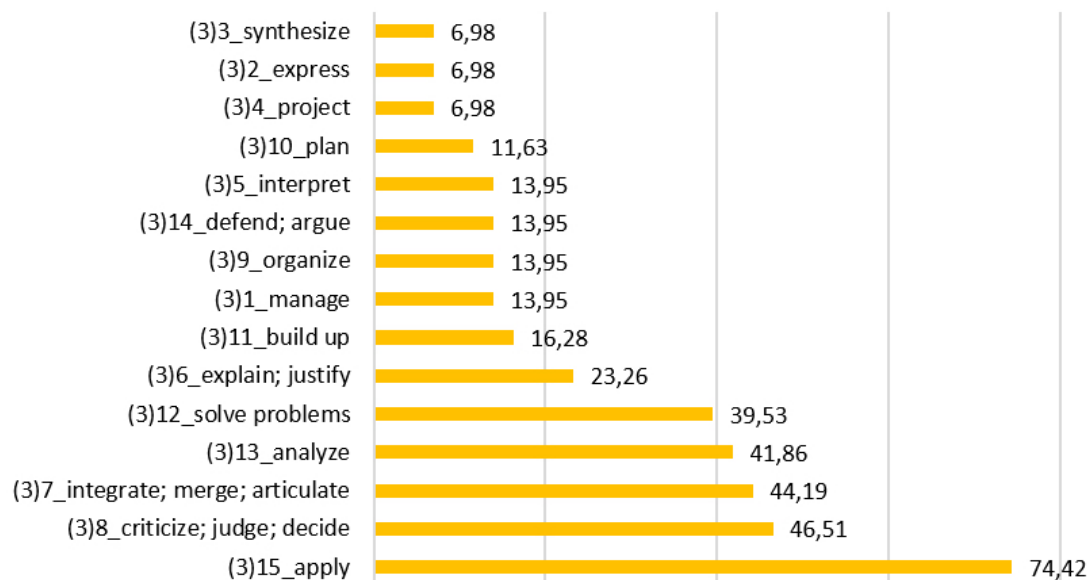


Fig. 3. Sublevels of high(3)-relational in study plans (%).

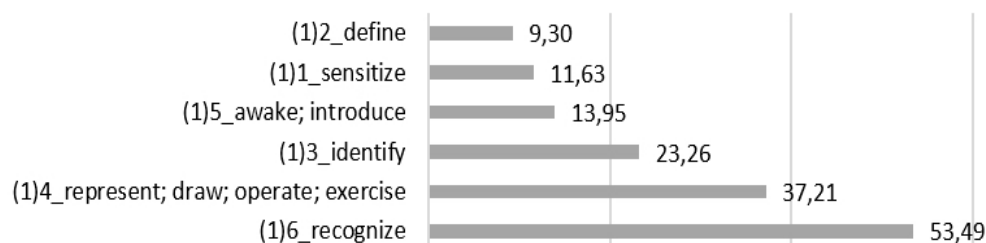


Fig. 4. Sublevels of low(1)-uni-structural in study plans (%).

Level high(4)-extended abstract, for which the sublevels are presented by frequency in Figure 5, stand for the third most represented level of knowledge. In this level, the most representative is (4)8\_create and compose, with 34,88%.

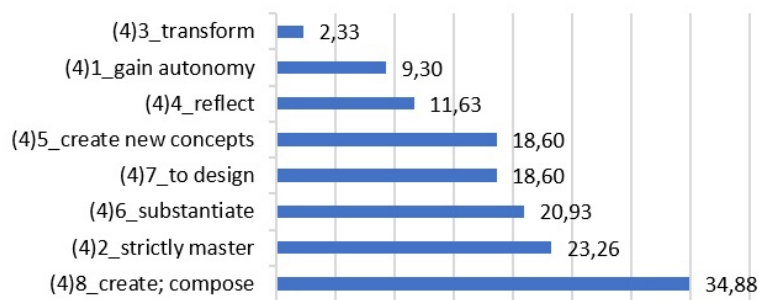


Fig. 5. Sublevels of high(4)-extended abstract in study plans (%).

Regarding the content topics matrix, (B)design fundamentals are the most frequent content topic. In the respective subcategories, in Figure 6, (B)2\_shape, presents the highest frequency, with 76%, followed by (B)3\_fusion fundamentals, with 65%, and by (B)1\_color with 30%.

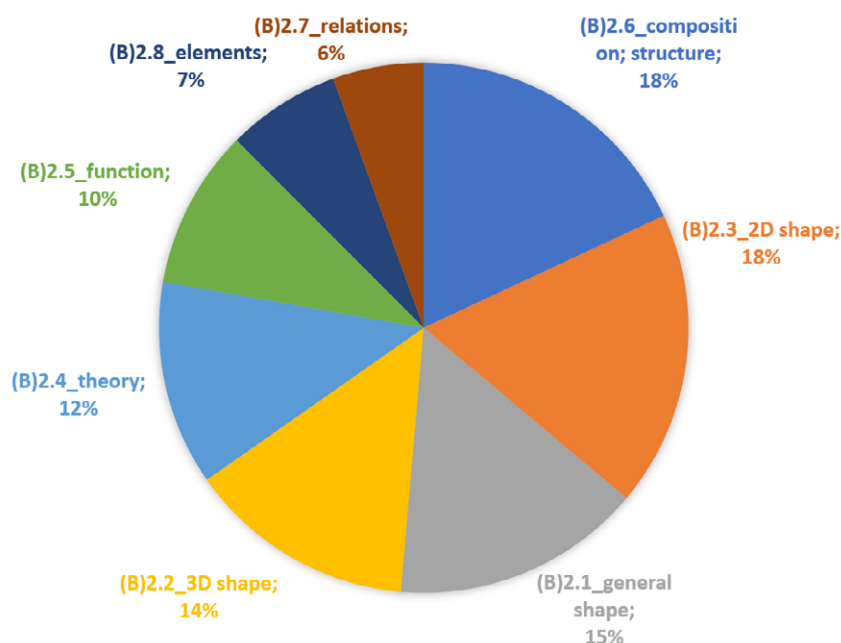


Fig. 6. Content topic sublevel (B)2\_shape, in study plans (%).

The second most frequent content topic addresses (E)personal values and skills, is presented with all the sublevels in Figure 7.

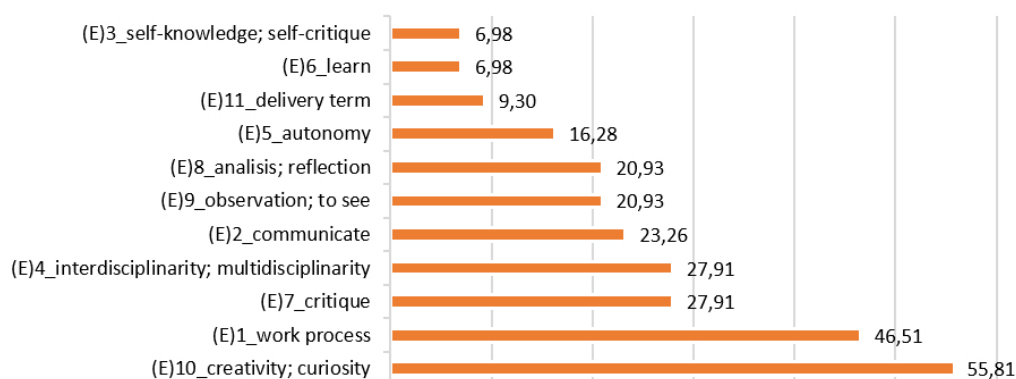


Fig. 7. Content topic (E)personal values and skills, in study plans (%).

### 3. RESULTS & DISCUSSION

The LOs micro-analysis of the Portuguese BD courses allowed us the identification of: i) the conceptual matrixes representing the levels of knowledge and the content topics, in the LOs; and ii) the most frequent combinations between the two dimensions of LOs: levels of knowledge (actions/verbs) and content topics (objects/content). Thereby, the high(3)-relational level, combined with the content topic (B)-design fundamentals, is found to be the most frequent, immediately followed by the combination using high(3)-relational level, with the content topic (E)-personal values and skills.

In Tables 3 to 5, we present some examples of the three most frequent combinations, using the high(3)-relational level, with (B)-design fundamentals (79%), followed by (E)-personal values and skills (60,5%) and (C)-project (55,8%), gathered from this analysis.

Table 3. High(3)-relational X (B)-design fundamentals.

Level X Content Topic	Learning Outcome	Study Plan
high(3)-relational\ (3)11_build up X (B)-design fund.\ (B)2_shape\ (B)2.6_composition; structure	"Plan the procedures needed to build less complex shapes or systems"	4 DPIE
high(3)-relational\ (3)9_organize X (B)-design fund.\ (B)2_shape\ (B)2.6_composition; structure	"Develop the ability to organize the elements that structure two-dimensional discourse"	43 DGCM

Table 4. High(3)-relational X (E)-personal values and skills.

Level X Content Topic	Learning Outcome	Study Plan
high(3)-relational\ (3)12_solve problems X (E)-per. values and skills\ (E)10_creativity; curiosity	"Appreciation of the process as a creative means for the discovery of new original solutions..."	11 DPIE
high(3)-relational\ (3)15_apply X (E)-personal values and skills\ (E)10_creativity; curiosity	"Use of creativity innovation strategies"	40 G

Table 5. High(3)-relational X (C)-project.

Level X Content Topic	Learning Outcome	Study Plan
high(3)-relational\ (3)15_apply X (C)-project\ (C)1_project; methodology	"ability to use a methodology"	2 DIEA
high(3)-relational\ (3)15_apply X (C)-project\ (C)1_project; methodology	"implementation of procedural methodologies"	16 DGCM



The second most frequent level verified in the LOs was low(1)-uni-structural level, being present in 83,72% of the study plans. This may be due to that it is an introductory first-year design course, and thereby, does not require a deep knowledge at this learning stage (Biggs & Tang, 2007). The combination of low(1)-uni-structural level with (B)design fundamentals is the fourth most represented content in the study plans (53,5%). Following, in Tables 6 to 8, we present some examples of LOs pointing the specific sublevels.

Table 6. Low(1)-uni-structural X (B)-design fundamentals.

Level X Content Topic	Learning Outcome	Study Plan
low(1)-uni-structural\ (1)6_recognize X (B)-design fund.\ (B)3 fusion fund.\(B)3.4 relations	"Recognize the concepts of measurement, scale, proportion and hierarchical relationship..."	25 DGCM
low(1)-uni-structural(1)3_identify X (B)-design fund.\(B)3_fusion fund.	"Identify the key elements of the field and visual language in the image, space, form and typographic font"	27 DTM

The high(4)-extended abstract level is the third most frequent level found in the LOs present in the Portuguese BD study plans (Neves, Dias, Duarte & Ramalho, 2019). According to Biggs and Tang (2007), the use of this level on the LOs is indicative of the contents expected to be performed at the highest cognitive level, thereby, revealing the most important contents to be learned and essential to the course (Biggs, 2003). As can be noticed in Figure 2, the LOs that represent the high(4)-extended abstract level are combined with the content topics (E)-personal values and skills, followed by (B)-design fundamentals, respectively, with 51,2% and 41,9%.

Table 7. High(4)-extended abstract X (E)-personal values and skills.

Level X Content Topic	Learning Outcome	Study Plan
high(4)-extended abstract\ (4)1 gain autonomy X (E)-per. values and skills\ (E)10 creativity; curiosity	"Developing student creativity and autonomy and understanding the broad concept of design"	39 G
high(4)-extended abstract\ (4)8_create; compose X (E)-per. values and skills(E)7_critique	"Create with authenticity and critical sense"	23 DGCM

Table 8. High(4)-extended abstract X (B)-design fundamentals.

Level X Content Topic	Learning Outcome	Study Plan
high(4)-extended abstract\ (4)5 create new concepts X~ (B)2_shape\ (B)2.3_2D shape	"Establish proportional relationships between parts and whole while safeguarding harmony and balance..."	28 DGCM
high(4)-extended abstract\ (4)5_create new concepts X (B)2_shape\ (B)2.1 general shape	"Capacity for formal and plastic abstraction"	2 DIEA

As observed, the most important content topics (i.e., the ones combined at the highest level of knowledge, high(4)-extended abstract) were also the most frequent, despite appearing in reverse order (i.e., firstly, (E)-personal values and skills, followed by (B)-design fundamentals).

Likewise, we also highlight the most frequent content topics subcategories, such as (E)10\_creativity; curiosity, in (E)-personal values and skills; and (B)2\_shape\ (B)2.6\_composition; structure, in (B)-design fundamentals. These might be considered for integrating learning experiences for the first-year design students. The results also confirm the idea advanced by Biggs and Tang (2007) that in the HE systems the outcomes would be predominantly high level.

## 4. CONCLUSION

In this paper, we present a LOs micro-analysis of the Portuguese BD courses that may contribute to addressing educational challenges much beyond that context. While focusing the LOs in the HE systems, we can walk through all the macro-micro scale and, thereby, afford quality learning in the



global era.

Firstly, with this study, we improved the conceptual matrixes previously created and enriched the conceptual frame. It allowed us the definition of the levels of knowledge and the content topics presented in the LOs to conduct the subsequent micro-analysis study. The conceptual matrixes represent, in some way, the structure of the Portuguese BD course, in terms of the mentioned LOs components. Simultaneously, they reveal a hierarchic conceptualization that can be useful for structuring the learning design of BD courses.

Secondly, the combinations highlighted that the content topics related to personal values and skills and design fundamentals are common in both frequency and importance. We notice that the BD Portuguese context, similarly to the preliminary course, reaffirms the importance of those contents, making them more recommended to integrate BD learning tools on a fundamental basis.

We could advance from here the development of a tool which considers a common minimum structure, informed by the most prominent combinations of levels of knowledge and content topics. The minimum structure could address the combinations: level of knowledge high(3)-relational with contents (E)-personal values and skills and (B)-design fundamentals; the level of knowledge low(1)-uni-structural with (B)-design fundamentals; and level of knowledge high(4)-extended abstract with (E)-personal values and skills.

Further developments of the micro-analysis may consider attributing hierarchical values to each combination. It would add the development of a common minimum structure shared by BD courses worldwide, adaptable to different spaces, places, circumstances, mediums, times and learning ages. It could serve several design areas, teaching methodologies and pedagogical approaches. Finally, it could support

the development of student-centred learning design tools that considers students interests, talents and creative power, in the process of becoming a designer. Each student could state a preference for a specific design area or for more than one, enabling the highest possible level of understanding topics of design fundamentals such as: formal coherence, harmony, or symmetry. If provided by an immersive virtual environment, the experience can also allow learning to take place from direct experience, as in the real-world experiences. Winn (1993) pointed out that there is unique compatibility between the characteristics of immersive VR and the constructivist learning theory

If considered in alignment with programme outcomes and graduate attributes, this micro-scale analysis opens the opportunity for the creation of BD learning tools and experiences guided by the significant LOs for all designers that take in consideration the unique characteristics of each individual.

As already mentioned, also other courses in design education and in other different areas can benefit from conducting such a micro-scale analysis for this broad micro-macro perspective.

## ACKNOWLEDGEMENTS

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# Who's Missing from the Design Classroom? We Need More Diversity among Learning Enablers in the New Design Learning Spaces



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## Abstract

The design field is experiencing a turmoil due to the complex new problems humans are facing. Moreover, the once well-defined boundaries of design are evolving so expansively that apparently nothing is completely immune to this phenomenon. Consequently, the scale and pace of these new problems defy the design field and designers to provide new approaches, and new ways of coping with the constant demand for new learning. Design practice is shifting faster than design education, posing challenging problems for the university. This paper looks at the current design classroom from the point of view of its players – the students and their teachers –; the way they perceive the need for changes; their proposals and what they anticipate as future design learning spaces. Coupled with this approach, we also make an attempt to correlate all of these changes with new ways of learning based on heutagogy, and how it challenges teaching and learning design. In order to better understand how these problems are perceived, a questionnaire was conducted among design students, teachers and professionals of the field. Design education and its prevailing models are teacher-centred, still proposing learning models not responding to the rapidly shifting world of *co-everything*. It seems evident that learning how to learn design has become an absolute necessity for the future. As a result, we anticipate new design learning spaces based on self-determined models and spaces gathering new *design learners* – design students, design professionals, and practitioners from other fields.

## Keywords:

**Design Learning, Heutagogy, Diversity, Learning Enablers**

# 1. Design and Design Education – A Global Turmoil After Boundaries and Disciplines

The design field is experiencing a global turmoil due to the complex new problems we are facing today. This disturbance can also be witnessed at any design related discussions within schools, forums, the practice field and of course academic design conferences. This paper was written in the context of Senses&Sensibility 2019, a biannual conference on Design, organised by UNIDCOM/IADE and hosted by IADE

– Universidade Europeia, in Lisbon, Portugal [<http://senses2019.unidcom-iade.pt/>]. Twelve thematic tracks were proposed, Design Education being one of them. We found it particularly relevant that out of 99 submitted papers, 17 of them were presented and discussed under the Design Education track. No other track theme had more participation and discussion.

This introduction borrows its title from the book “Design School. After Boundaries and Disciplines” (Rodgers & Bremner, 2019) and tentatively tries to map the context in which designers, design professionals, and design lecturers perceive the need for change at the design school. As the authors put it, design education and practice are in *suspension* mode, looking for the possible and its associated problematic (Rodgers & Bremner, 2019, p.1). Furthermore, Rodgers and Bremner warn about the menaces the university is facing, namely all the ongoing discussions, at all levels, about design education, and a growing wave of informal alternatives to the formal university, like online courses, MOOCs, free “schools”, and other manifestations of a global protest against the way we still teach and learn design.

Aligned with this way of thinking is Meredith Davis, calling for a new design curriculum able to cope with a radically *changed environment and*

*scale of activity* (Davis, 2017), bearing in mind that this new curriculum will have to address and serve a new kind of designer, one who is more concerned about social and human values than his/her predecessor, rooted in arts and crafts. By the same token, what kind of new design learning paradigm will emerge to operate in a world where everything changes so rapidly? Ken Friedman (2019) observes:

*Design is a discipline, a field, and a profession. Inherently interdisciplinary, often focused on a future that does not yet exist, the work of design involves solving problems for multiple stakeholders in a complex changing world. [...] Educating people for the design field today involves the legacy of the past and the challenges of the future. [...] design education is a practical art and an emerging science that requires the full resources of the modern university at a time when the university itself faces extraordinary demands. (Friedman, 2019)*

Design practice classical boundaries are now blurred with many other fields, if not all of the knowledge areas. Nonetheless, design practice, and specially its education are still lacking new strategies to cope with a demand for new designers prepared to respond to the post-industrial problematics, their scale and pace. Moreover, if new designers are required, then new ways of teaching and/or learning are required in design education. The scale and pace of these new problems defy the design field to provide new learning approaches to cope with a constant demand for new learning.

Throughout its history, design teaching has been practice-based, project oriented, developing skills, and learning alongside peers in the studio and through workshops (Tovey, 2015). Tovey adds that it is expected that students become independent, self-analytical, and critical thinkers but the actual classroom, although trying new moves,

is still way behind what is already happening in more informal, flexible and open design learning projects based on self-directed learning, nourished by a wide range of learning enablers. Additionally, working, learning, and living seem to become one single dimension in our lives, leading us to the main question of our doctoral research: How will the future design classroom be open to all fields of knowledge?

## 2. THE DESIGN CLASSROOM AS SEEN BY STUDENTS, TEACHERS AND PROFESSIONALS

### 2.1. 20 QUESTIONS TO DESIGNERS, STUDENTS & DESIGN TEACHERS

We look at the current design classroom from the points of view of students, teachers, and professionals trying to understand:

- What they anticipate will be the future design learning spaces.
- The way they perceive the need for changes.
- Who should share such a new design classroom.
- New learning alternatives based on new ways of work and its new spaces.

A questionnaire (n=571) was distributed to design students, teachers and professionals of the field: "20 Questions to Designers, Students & Design Teachers". A particular question was asked these three groups: "Who would you bring to a future design learning space beside students and teachers?". Although this is an ongoing and partial analysis to be fully presented in our research project, data was extracted and analysed from the answers to this particular question (table 1). The questionnaire was available for one year, from July 2018 to July 2019.

Table 1. Who would you bring to a future design learning space beside students and teachers?

#### Option

- ☐ Design professionals & others
- ☐ Design professionals
- ☐ Students from other fields
- ☐ More than one teacher
- ☐ All of the above
- ☐ Nobody else

The questionnaire resulted in 571 replies, expressing a surprising and relevant interest in design education, specifically on what could change inside the design classroom. The following table (Table 2) shows the overall data about age, gender, origin and role of the participants.

Table 2. 571 participants

#### Results

**Age:** -21 (8,42%) | 21/28 (42,55%) | 29/34 (17,51%) | 35/45 (20,84%) | +45 (10,50%)

**Gender:** Women (64,79%) | Men (34,15%) | Prefer not to say (1,06%)

**Origin:** (2,10%) Portugal (84,93%) | Brazil (9,45%) | Portuguese speaking countries | Other European countries (3,15%) | Other countries (0,37%)

**Participants:** Designers 361 (63,14%) | Students 152 (26,7%) | Teachers 58 (10,15%)

As shown in Table 2, the questionnaire had a prominent participation from young people (between 21 and 28 years old), as slightly more than 50% of the participants were less than 30

years old. Expressly and equally important is the number of women participating, almost double the number of men. Although presented in Portuguese, around 15% of the answers came from designers, design students and design teachers from virtually all parts of the globe. Finally, we would like to emphasise the expressive participation of design practitioners, apparently showing a greater interest on what should change inside the design classroom than those naturally more connected to teaching and learning, i.e. students and their teachers. The following tables (Tables 3, 4, 5, and 6) show the global and partial results, divided into the three categories of participants.

Table 3. Aggregated results. 571 teachers answered this question.

Option	Results
<b>Design professionals &amp; others</b>	<b>233 (40,80%)</b>
<b>Design professionals</b>	<b>78 (13,66%)</b>
<b>Students from other fields</b>	<b>36 (6,30%)</b>
<b>More than one teacher</b>	<b>19 (3,32%)</b>
<b>All of the above</b>	<b>200 (35,02%)</b>
<b>Nobody else</b>	<b>5 (0,87%)</b>

Design students, teachers, and professionals clearly indicate the need to bring other players into the design classroom. The majority of players express a desire to bring professionals from design as well as from other fields. Less than 1% (5 participants) show no interest in bringing new players.

Table 4. Partial results. 58 teachers answered this question.

Option	Results
<b>Design professionals &amp; others</b>	<b>17 (29,31%)</b>
<b>Design professionals</b>	<b>0 (0%)</b>
<b>Students from other fields</b>	<b>6 (10,34%)</b>
<b>More than one teacher</b>	<b>4 (6,89%)</b>
<b>All of the above</b>	<b>29 (50%)</b>
<b>Nobody else</b>	<b>2 (3,44%)</b>

Table 5. Partial results. 361 designers answered this question.

Option	Results
<b>Design professionals &amp; others</b>	<b>112 (31,04%)</b>
<b>Design professionals</b>	<b>48 (13,29%)</b>
<b>Students from other fields</b>	<b>17 (4,71%)</b>
<b>More than one teacher</b>	<b>8 (2,21%)</b>
<b>All of the above</b>	<b>174 (48,20%)</b>
<b>Nobody else</b>	<b>2 (0,55%)</b>

Table 6. Partial results. 152 students answered this question.

Option	Results
<b>Design professionals &amp; others</b>	<b>28 (18,42%)</b>
<b>Design professionals</b>	<b>25 (16,44%)</b>
<b>Students from other fields</b>	<b>13 (8,55%)</b>
<b>More than one teacher</b>	<b>7 (4,60%)</b>
<b>Students from other grades/years*</b>	<b>4 (2,63%)</b>
<b>*extra option</b>	
<b>All of the above</b>	<b>74 (48,68%)</b>
<b>Nobody else</b>	<b>1 (0,65%)</b>

In conclusion, these results clearly show evidence of a global perception that the prevailing models, still teacher-centred, must change, and that new learning models and spaces are needed to effectively respond to the rapidly shifting world of co-every- thing, co-learning included. Accordingly,



new design learning spaces should be more inclusive, bringing together the widest diversity of players from all areas of knowledge, this diversity of players inside the classroom being a transversal primary choice for all the respondents. Moreover, new learning models must accommodate these new students, their specific skills, and their demand for constant learning to cope with rapid changes in the world.

The next section describes and proposes a self-determined learning approach towards new design learning models supported by the inclusion of “design learning enablers” instead of the above-mentioned teacher-centred model. Under those new circumstances, the teacher’s role will change to a less central position, sharing that role with other learning enablers to produce new ways of learning to be, act and work as a designer.

### 3. SELF-DETERMINED DESIGN LEARNING

#### 3.1. WHAT IS HEUTAGOGY?

Heutagogy is the study of self-determined learning, also described as self-directed, autodidacticism, autodidactism, self-education, self-learning or self-teaching (‘Autodidacticism’, 2020). Although citing Wikipedia is not a common practice among academic researchers, this decentralised web platform is interesting evidence of self-determined learning as it does not rely on the guidance of teachers and schools but instead on the will of individuals, eager to contribute to open and free knowledge. Throughout human history, many giant steps in arts and sciences originated from the *self-thinking* of autodidacts. Heutagogy proposes a profound change in education as it focuses on *what and how to learn* as the learners’ responsibility, instead of the more passive act of being taught (Hase & Kenyon,

2013), dramatically changing from *teacher-centred learning* to *learner-centred learning*, as this author states. Moreover, heutagogy, as an alternative to pedagogy, has been considered as more appropriate for new learners of the 21st century, constituting a better and natural educational methodology (Hase & Kenyon, 2001). A new approach to learning in a world that is guided by decentralised networks and technology is the target. Moreover, for the new generations, heutagogy seems to be their natural *modus operandi* of learning (Heick, 2015), given that the entire internet is, in a way, a self-determined diffuse system where each individual has equal possibilities of designing his/her own learning.

#### 3.2. SELF-DETERMINED DESIGN LEARNING REQUIRES NEW DESIGN LEARNING SPACES AND ENABLERS

Who’s missing from the design classroom? This paper started by pointing out the need for more diversity inside the design classroom, including new learning enablers to change the paradigm of design education. Furthermore, the analysis of our long questionnaire proved designers, design students and even design teachers feel the urge to bring more actors to the design learning space, ranging from professionals of design and other fields; students from other academic fields; and a discrete claim for the breaking of the one-teacher system.

Accordingly, this scenario can be interpreted as a desire for a permeability of actual design learning spaces. Once inside a classic classroom, design students often find themselves caged in a *one size fits* all learning mode, led by a single teacher, and away from real life, real problems, real projects, and their own life, problems, and projects. How can such a learning environment address, for instance, the problem of mobility in our cities? In semi-permeable schools and classrooms, efforts are conducted by the university to bring companies and institutions into their classrooms.



Nevertheless, it is unlikely that those students will have the input of peers and professionals bringing complementary skills to address complex problems. It is therefore a problem of permeability we are facing.

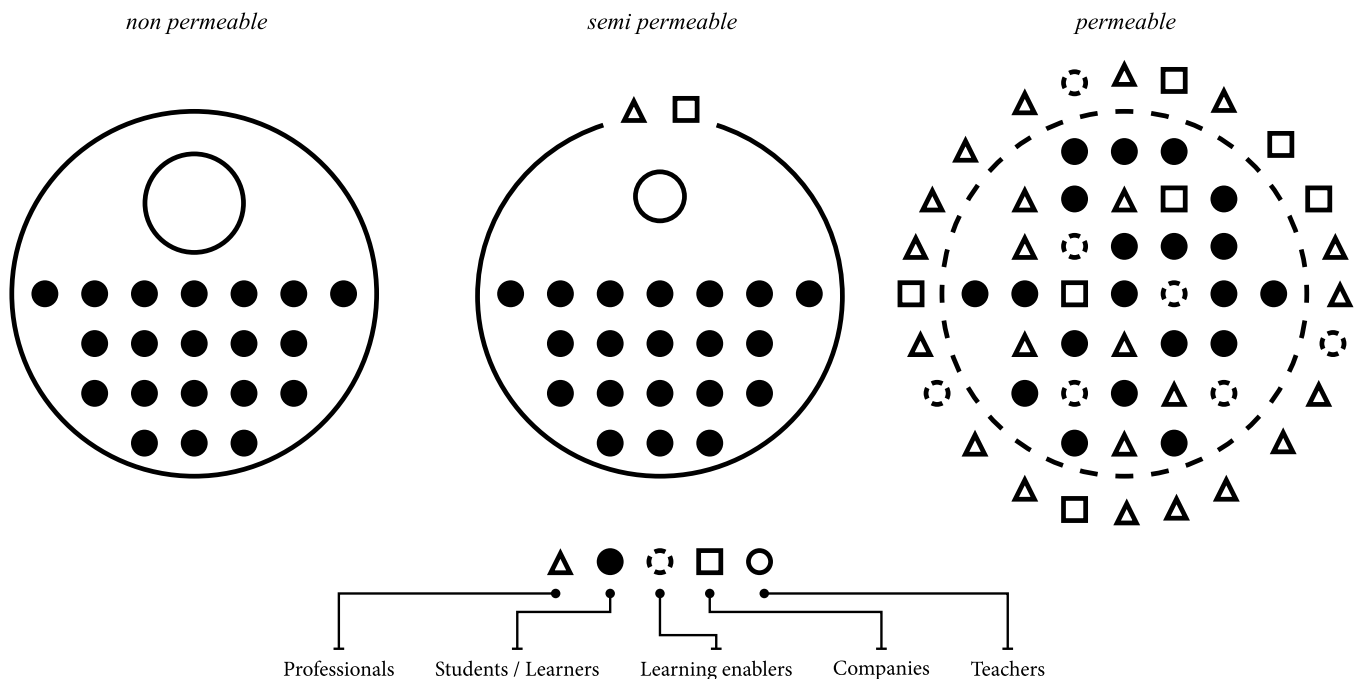


Fig. 1. Permeability of design learning spaces (Mendes, Fernando. 2019).

Designers can no longer learn alone, with one teacher, isolated from the “real world”. A more permeable classroom must open its boundaries to other learning peers. In order to clarify this vision, a graphic visualisation is proposed (Fig. 1). This graphic vision of the permeability of three different classrooms identifies the key players of a self-determined design learning space. On the left, a classic non-permeable learning space, nowadays slowly disappearing but still operating globally, where the teacher has a central position. In such classrooms, students are in a static position, with no or scarce possibilities for self-decision about

what and how to learn. It is often called the *one size fits* all education, in conflict with the digital world aimed at customisation (of learning, living, working, etc.) at an individual point. In the centre, perhaps the most common design learning space of our days, usually focused on problem-based pedagogical models, making efforts to bring the “real world” to the class- room. These efforts are sometimes undermined by the formality of the university, keeping a gate at the entrance of the classroom, i.e. *credentialism* (the reliance upon formal credentials conferred by educational institutions, for instances) keeps out many professionals, companies and institutions because their staff do not comply with the academic rules. The teacher still plays a central role, although

less central, allowing the presence/intervention of regularly invited professionals or companies representatives, not resulting in a real and effective alteration of the learning place. Finally, the last graphic on the right tries to represent what could look like a self-determined design learning space. First of all, its boundaries are totally permeable, in line with all the co-spaces emerging in our society. Consequently, getting in and out would be a personal decision of the learner, be it a student, a professional, a company or an institution. The former teacher is now a *learned person* (Hase & Kenyon, 2013) acting as a guide and a learning enabler, and he/she is never alone in the learning place.

Comparatively, design thinking principles share some similarities with heutagogy, mostly because of the same human-centred approach, co-creation methodologies, and a similar role between the *learner enabler* in heutagogy and the facilitator in design thinking (Tschimmel et al., 2017). Moreover, Tschimmel defends that teaching and learning can now happen whenever and wherever we want, and that this endeavour is no longer confined to universities or schools. Tschimmel et al. (Tschimmel et al., 2015) urge educators and organisations to rethink the learning space in order to cope with new contingencies impacting the way we learn, namely technology. Consequently, if more diverse learning enablers are needed, more diverse learning places will have to be imagined. To sum up, a new design learning space will have to accommodate a diversity of players, a diversity of class methods and methodologies, and probably a diversity of new learning approaches (Tschimmel, 2010).

## 4. CONCLUSION

We strongly believe future design learning models and spaces will be open to all areas of knowledge as it seems to be the best way to accommodate a diversity of learning enablers to address the new challenges designers face today. We also envision new learning methodologies based on self-determined modes of learning, although not in an exclusive way.

In the long run, this could result in a new design learning model coupled with a new kind of studio-based design learning, a new studio gathering learners and professionals from all fields of knowledge instead of just design related participants. More- over, this description immediately resonates with the new collaborative workplaces, like coworking spaces, maker spaces, and others open-to-all self-determined by nature spaces collapsing work, life and learn under one single roof.

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# The Transdisciplinary Dilemma: Models for Mitigating Complex Problems in Higher Education

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## Abstract

Design practices once emphasized form and function, but design problems are now situated within larger systems that cross disciplinary boundaries. Our interconnected world means that these problems are complex, and must be addressed through greater systems that incorporate methodologies, knowledge, and perspectives from multiple disciplines. As a result, the graphic design discipline, specifically, is expanding, and contemporary practice is becoming characterized as fluid and hybridized. In higher education, new critical competencies are being identified for current and future practitioners, including systems thinking, sustainable frameworks, and interdisciplinary work models. Using case studies from BFA programs in Graphic Design, this paper examines inter-/multi-/transdisciplinary academic minors, design studios, and assignments, and addresses the motivations, advantages, disadvantages, and reflections of each pedagogical model. The discussion is framed by AIGA Design Futures, a critical dialogue about the trajectory of the graphic design discipline that is developed through The Professional Association for Design (AIGA). Rather than providing concrete answers, this research is a developing resource that offers pragmatic insights for each educational model.

### Keywords:

**Design Futures, Transdisciplinary Design, Higher Education, Teaching, Complex Problems**

## 1. INTRODUCTION

Disciplinary boundaries are blurring in design-related fields and contemporary design practice is becoming increasingly characterized as fluid, hybridized, and collaborative. Design problems are complex, and must be addressed through greater systems that incorporate methodologies, and knowledge, perspectives from multiple disciplines. For educators and students alike, the university is best situated to provide opportunities to meet, share, discuss, and learn from one another. The question is, how and what do we teach our students in this changing disciplinary landscape?

This paper discusses a series of case studies that contribute to a developing resource for design educators and administrators by considering the effectiveness and challenges of different *multidisciplinary*, *interdisciplinary*, and *transdisciplinary* educational models. They focus on pedagogical models from two institutions in the United States: Lawrence Technological University (LTU), a private university in Southfield and Detroit, Michigan, and Pennsylvania State University (Penn State), a public university in State College, Pennsylvania. Offering useful lessons, the discussion of each model addresses the effectiveness, challenges, and student experience. *Wicked problems*—a term introduced in 1973 by design theorists Horst Rittel and Melvin Webber and applied to issues such as health epidemics, terrorism, global warming, and sustainability (Rittel & Webber, 1973)—have been driving innovation in design fields. According to the Environmental Humanities Working Group at Stonybrook University, “Unlike the ‘tame’ problems of mathematics and chess, the wicked problems of planning lack clarity in both their aims and solutions (Stony Brook University, n.d., para. 2).” Because wicked problems have an indeterminate scope and scale, Kolko (Wicked

Problems: Problems Worth Solving, n.d, para. 3) states that, “knowledge of science, economics, statistics, technology, medicine, politics, and more are necessary for effective change. This demands interdisciplinary collaboration, and most importantly, perseverance.”

Design finds itself connecting to other fields in the pursuit of addressing the complexities and challenges of contemporary problems. As Thackara (Thackara, 2006, p.99) states, “Learning happens best when people participate in different communities of practice.” By separating the implicit soft-skill aspects of design (facilitating, organizing, critical thinking) apart from the intuition and medium of output created by design professions, higher education may adapt students to this post-craft knowledge economy focused on networked collaboration. Collaborative education models promise theoretical benefits of their respective programs, their ability to produce valuable impact on social problems, and job readiness in the new professional climate (Introduction to Design Futures, n.d.). In reality, however, does the student experience align with this value proposition?

The intricacies of the topics posed by contemporary complex problems, though critical, make them contentious for our classrooms as they challenge us to develop new models that respond to the changing disciplinary landscape. Although institutional policies and politics often create limitations to how fully and quickly curriculum is able to evolve, new curricular competencies are emerging that are informing pedagogical development. Collaborative models serve many purposes, and may be deployed in different scales. Those include broad and shallow approaches such as academic minor, and also narrow and deep approaches such as collaborative design studios and assignments.

In terms of student learning and employability advantages, these models also inherently expand student experiences and make them more professionally nimble. Sternberg (Sternberg, 2008, p. 12) offers a problem-based model whose application takes aim at how “virtually all problems facing the world can be solved only through multidisciplinary thinking.” A *multidisciplinary* model refers to education and research on a certain topic within several disciplines at the same time. But, when discipline-specific teams apply methods and theory from other disciplines in their own way, this is called *interdisciplinary*. When the team works to dissolve disciplinary boundaries through coordinated integration efforts, it is *transdisciplinary* (Jia et al., 2019, p. 163) (Fig. 1). Sternberg (Sternberg, 2008, p. 14) argues that even though students are exposed to the work and research of students in other disciplines, the multidisciplinary and interdisciplinary learning may still perpetuate siloed (singular-discipline) methods and perspectives. This is because students are rarely taught how to integrate this learning into their own discipline.

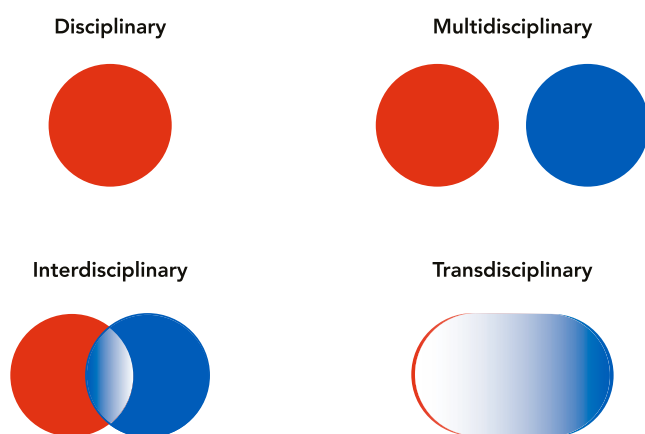


Fig. 1. Visualization of disciplinary, multidisciplinary, interdisciplinary, and transdisciplinary educational models.

## 2. CASE STUDIES

The following case studies discuss multidisciplinary, interdisciplinary, and transdisciplinary pedagogical models in a variety of tested case types, each serving many purposes. These will be presented in order of progressively deeper levels of engagement with collaborative learning models, with the degree of institutional policies and politics required for implementation being inversely proportional to the scale of deployment. First is a case for Academic Minors which demonstrate a somewhat limited depth of disciplinary collaboration to a broader number of students. Next is the case for two different Collaborative Design Studios, which demonstrate increasingly deeper levels of disciplinary collaboration to a more limited number of students. The final is a case for Assignments, which demonstrate a deep level of disciplinary collaboration to a limited number of students.

### 2.1 ACADEMIC MINORS

Academic minors add another area of specialization for non-design majors, and can more effectively build a foundation beyond an isolated experience or course. Minors in design-related disciplines, specifically, hold transferable knowledge and methodologies that are of value to many other disciplines. When students from outside disciplines are able to gain an understanding of design methods in practice, they may be applied in a new context.

At both Lawrence Technological University and Penn State, a growth scenario for the Graphic Design programs initially motivated the creation of a Graphic Design Minor program at each respective institution. The guiding principles of the curriculum development were to uphold the reputation of the major programs and to provide appropriate rigor in a minor.

As boundaries between disciplines continue to blur in the workplace—becoming increasingly interdisciplinary—discipline-specific teams apply methods and theory from design in their own way. At Penn State, outside colleges of Engineering, Computer Science, and Business now recognize the value of creative “design thinking” as a means of problem-solving, and the minor filled a demand for this methodology. At LTU, the minor filled a demand from students in more closely-related programs of Architecture, Interior Architecture, and Media Communication who were interested in enhancing the visual communication abilities.

## REFLECTION

Students in the Graphic Design Minor at Lawrence Technological University have communicated—through anonymous course evaluations of current students and through informal communication of alumni—that learning visual communication tools were helpful, but the positive feedback does not go much deeper. One alumna stated, “I will say overall, learning Adobe Illustrator has been really useful in my current job!” (Personal communication, October 21, 2019).

The minor programs at the respective institutions, in particular Penn State, enabled the Graphic Design programs to incorporate perspectives from outside disciplines, becoming multidisciplinary by beginning to de-silo the single-discipline perspective of the major. Academic minors, however, do not easily provide the framework for students to tackle today’s problems in their full complexity. Further, the ability for an academic minor to de-silo a major is still limited.

As Sternberg (Sternberg, 2008, p. 14) explains, “The current system poses three problems. First, in the first two years of college, students learn to think in silos rather than in an interconnected, multidisciplinary way. A problem-based major or minor provides a way for students to see beyond such silos. Second, when they major (and possibly

minor), students learn to think more deeply in one or perhaps, in the case of double majors, two of these silos, still without learning what is most important: how to integrate the knowledge across silos. (. . .). Third, students may not realize how limited their thinking is.”

This model indeed exposes students to other areas of study, perspectives, and methodologies, yet the indirect integration of these new methods and perspectives into one’s own discipline tends to be limited.

## 2.2 COLLABORATIVE STUDIOS: SENIOR THESIS

Because contemporary problems are increasingly embedded within complex systems, teams must now integrate “knowledge and skills well beyond the typical domains of design (Sternberg, 2008, para. 21),” such as data science, psychology, and anthropology.

In fall 2019, the capstone experiences of the undergraduate-level Graphic Design, Game Art, and Game Software Development programs at Lawrence Technological University have developed into a unified experience. Over the course of two semesters in a shared studio environment, students identify a researchable problem and develop a design-focused project in response. Following a design-thinking process, the first semester emphasizes discovery, exploration, and iteration, and the second semester focuses on project development and dissemination through exhibition-related opportunities. In order to better inform projects, students also consult with experts beyond the disciplines within the course itself.

## REFLECTION

Regardless of whether students chose to develop their thesis projects as a team or independently,



sharing ideas in critiques and working in the same studio exposes students to each discipline's respective design methodologies, tools, and insights from diverse perspectives. This is effectively a multidisciplinary model. Encouraging an interdisciplinary or transdisciplinary model where students integrate their knowledge in teams was more challenging. There are several collaborative studios prior to this senior capstone experience that are either shared between Graphic Design and Game Art students, or between the Game Software Development and Game Art students. This is the first time, however, that Graphic Design students have had the opportunity to directly work with the Game Software Development students within a course. For this reason, fostering an effective collaborative environment between these two disciplines, in particular, has proven difficult. It is therefore imperative that there are assignments and activities embedded at the beginning of the semester to help break down disciplinary boundaries to foster more effective collaboration. Even further, it would be productive for the disconnected disciplines to be introduced in a collaborative studio or experience prior to the senior year.



Fig. 2. Screen shot of a collaborative project between a Game Art student and a Game Software Development student that is addressing climate change through an interactive game experience.

## 2.3 COLLABORATIVE STUDIOS: NEW MEDIA

New Media, a junior-level studio course that is required for both Graphic Design and Game Art majors at Lawrence Technological University underwent recent curricular development with issues of interdisciplinary and transdisciplinary learning in mind.

The course focuses on emerging technology, and is driven by user experience (UX) and user interaction (UI) design. For the core project work, students work in interdisciplinary teams, utilizing the varied skill sets, perspectives, and design methodologies to arrive at innovative design solutions.

Fall 2019 was the first semester that the course was taught by a UX researcher who has a PhD in Psychology, as opposed to a conventional design practitioner. In order to ensure there was a deepened experimentation with design tools and a continued critical application of design principles, guest industry experts conducted short-term workshops for key projects in the course, specifically in the areas of virtual reality (VR), the Unity engine, user research-informed interactive design, and design for accessibility. With the course being driven by interaction design, and therefore focused on the user of each design solution, the professor's tangential expertise enhanced students' existing understanding of UX.

## REFLECTION

Emphasizing collaboration between the academic majors and also receiving instruction from diverse areas of expertise, the studio was significantly integrated and could be considered a transdisciplinary model. In this scenario, however, students felt apprehensive about working in ways that appeared to be outside of their respective major areas of study.



According to course evaluations, students expressed skepticism about their ability to effectively contribute to assignments in the course. One student stated: "My hesitation about this assignment is born out of my complete lack of knowledge in this field and irrelevancy to my discipline. I am a 2D graphic designer who has never worked in a 3D digital space or with VR in any capacity. I am also not an interior designer, capable of creating a fully fleshed out interior space." (Mid-term course evaluation, fall 2019). Another echoed a similar sentiment of anxiety: "I fear for the final project. As a graphic designer, I know nothing about Unity, I can't imagine I'll be very useful to my group knowing nothing about VR chat rooms, Unity, or basically anything about the project. I don't believe it's fitting for most of the class (with the exception of maybe Game Artists)." (Mid-term course evaluation, fall 2019). Sensitive to students' trepidation about venturing into unfamiliar academic territory, faculty were advised that as a junior-level course, students should be at a point to accept the challenges of the new content. In an effort to build confidence, faculty also communicated to students that the goal of these kinds of assignments were about drawing from, and expanding on, their known skill-sets and methodologies in a collaborative setting. Further, faculty communicated to students that the goals of the assignments are not focused on portfolio-worthy perfection, but rather on experimentation and innovation.

This scenario would benefit from additional transdisciplinary experiences occurring earlier in the curriculum to provide students with more opportunities to build their confidence in effectively contributing to their team.

## 2.4 ASSIGNMENTS

In 2016, twenty undergraduate graphic design students at Penn State were led through a

practical systems-thinking assignment called the *Sustainability Design Project* that introduced systems thinking and sustainable frameworks within a graphic design studio course. The assignment was informed by the *AIGA Design Futures* initiative that anticipates the future trajectory of the graphic design discipline. The graphic design students applied visual design methodologies and created a systems map for the research team of humanitarian engineers. The map clarified the complexity of the sustainable agriculture solutions, and helped the team collaborate to develop an interactive construction manual that guided carpenters in the assembly and repair of the agricultural greenhouses. The project utilized an interdisciplinary collaborative model between Graphic Design and Humanitarian Engineering students in developing Greenhouses Revolutionizing Output (GRO), a sustainable entrepreneur venture in Xai-Xai, Mozambique. The pedagogical approach was decisively project-based learning to involve graphic design students as full contributors to a real-world humanitarian venture. The graphic design students' first task was to create a visual map of the GRO venture as a means to best understand interconnections of people, actions, information, and 'touch points'. In doing so, they became exposed to a system that contributed to their heightened analysis and strategic abilities applied to this complex design problem. This fell within Meadow's definition of a system as a set of things interconnected such that they produce their own pattern of behavior. According to Meadow, systems consist of tangible or intangible elements, held together by interconnections with an operational purpose. *Systems thinking* is the process by which we understand these interconnections that may or may not demonstrate favorable behaviors, and whose behaviors are likely to change over time (Meadows, 2008).

The second task for students was developing an interactive construction manual for a mobile

touchscreen device that instructs carpenters in the assembly and repair of the agricultural greenhouses. The existing GRO manual was thirty-six-pages, composed in Microsoft Word, predominantly text-based, written in English, and used amateur photographs and computerized diagrams. The graphic design students first identified problem areas of the manual including complex technical language, inaccuracies, typos, and unclear diagrams.

Over the course of three weeks the designers developed wireframes, a simple arrangement of outlined shapes that are supported by annotations to indicate content and functionality of the interface. The user interface (UI) and user experience (UX) process anticipated behavior of the users, and wireframes offer a low-risk prototype that may be used to conduct user testing, and based upon test outcomes, the interface design to suit a user's response. The students gained experience with user testing through a "paper prototype" where printed copies of wireframes were presented to each other to simulate use of the interface.



Fig. 4. GRO greenhouses

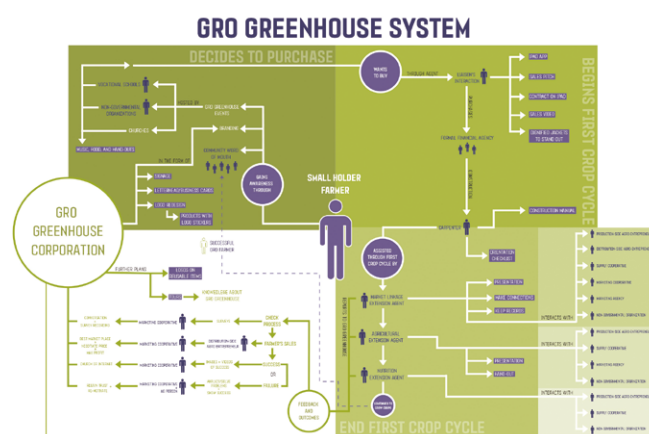


Fig. 5. Systems map

## REFLECTION

The systems map assignment was met with skepticism. For one, students did not understand the professional viability or portfolio potential of system maps. Secondly, the graphic design students were equally hesitant about group work models. The assignment challenged the students' perception of how designers work, not as neutral mediators, rather as strategic thinkers and stakeholders in outcomes from the work. Developing solutions to complex problems, they came to realize, requires a collaborative approach which shifts the notion of ownership in a project. One student commented, "There was so much involved in this project that I knew nothing about, such as the construction process of the greenhouses, and the cultural and social differences of places like Mozambique and Sierra Leone where GRO greenhouses were being constructed." (Personal correspondence, 2016). This furthered the decision to implement the *Sustainability Design Project* under the project-based learning model, as opposed to problem-based learning that generates single-subject

solutions under notional scenarios. The latter approach places emphasis upon a uni-disciplinary view of their individual portfolios.

### 3. INSIGHTS

Designers practice in an age of complex problems, where supplemental education, methods, partnerships and reliance on collaborators are increasingly required in their practice. Because of this trajectory, educators must critically examine pedagogical models that effectively prepare students for this evolving profession.

The case studies discussed thus far reveal that students tend to be hesitant to work in group settings regardless of the pedagogical model. When the models are interdisciplinary or multidisciplinary, where the student's collaborative role is clearly defined by their respective discipline, students seem somewhat receptive to the configuration. On the other hand, when disciplinary boundaries dissolve and the model becomes transdisciplinary, students are inclined to feel more uncertain about their ability to productively contribute to the project. Although transdisciplinary models are praised by Sternberg and also offer the most innovative and relevant pedagogical framework, it is more challenging to instill confidence in the students' ability to effectively participate in a problem-based collaborative scenario.

Students may also question the viability of a project when methods and project components do not clearly fit into a traditional design portfolio. With decades of design education emphasizing the formal qualities of design work, it is necessary to dismantle the portfolio-driven approach to design education. In problem-based education, the ability for students to discuss the "why" and "how" of a project may be just as significant—if not more—as the "what".

The integration of new pedagogical pursuits

must also begin early in design education. When students are introduced to new collaborative models and approaches to tackling design problems early in their curriculum, the culture of collaboration is considered natural as opposed to unfamiliar or forced.

This transdisciplinary dilemma in higher education itself is a problem with no simple solution or method of solving. For this reason, continued discussion with educators and testing of various approaches is necessary as higher education adapts to the new disciplinary landscape.

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# Virtual Reality and Interior Design History: Learning about Three Interior Spaces by Frank Lloyd Wright.

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## Abstract

This paper aims to present a preliminary research study comparing virtual reality (VR) with traditional methods as a learning tool in interior design history. In effect, the challenge remains not just how students learn but also how subjects are taught. This study intended to observe and evaluate the students' levels of interest, empathy and satisfaction in interior design history course. Three domestic spaces designed by the architect Frank Lloyd Wright, namely the Taliesin West House (1937), the David and Gladys Wright House (1952), and the Norman Lykes House (1959) were presented to interior design degree students, in VR and in expository method. The chosen domestic spaces allow a detailed interpretation of some parameters about design for dwelling, such as the relation between interior and exterior, light and shadows, and interior flow. The study involved 20 interior design degree third year students in a Portuguese Polytechnic, divided into two groups of 10. To each group was presented session as a classic design history lecture based on a PowerPoint presentation, and a non-immersive VR presentation of the same historical projects, in this case using a VR Cardboard Glasses and student's smartphone. At the end of each part of the session the students filled a survey to evaluate their interest in the course, and their levels of empathy/engagement and satisfaction with the method applied. The results showed that interactivity, namely VR environments, can be the key to connect the students with the topic discussed.

## Keywords:

**Interior Design History, Virtual Reality, Domestic Space.**

## 1. INTRODUCTION

This is a preliminary research study and it is integrated on a PhD project, on the online availability of virtual reality (VR) in Historical Portuguese Interior Design Project to promote history and facilitate the teaching and learning about the space. This pilot research aims to understand whether VR could be a valid tool for teaching and learning, and the limitations that this emergent technology can have in a typical class nowadays.

We are living in the digital era (Chatfield, 2012) and although it is known that new technologies are extremely used by students nowadays, it is also notable that they are not necessarily used as a tool in the learning process, in the classroom or at home. As Babich mentions “being educated isn’t the same as being informed” and as a result of the amount of information the students “become bored, disengaged, and usually not sure why they are learning about a topic in the first place” (Babich, 2018). And as Margolin advocates, history is the most important course because it should explain the profession and develop a critical attitude, connecting the theory to *praxis* (Margolin, 1996).

Therefore, we are interested to study if by using a new technology as the tool to promote a more inspiring and updated learning process could be the key to engage the students with the Interior Design History course.

In this research was intended to observe and evaluate the students’ levels of interest, empathy and satisfaction comparing traditional methods of teaching with a format supported in non-immersive virtual reality (VR) as the tool. It was used the VR Carboard Glasses because it allows the user to remain aware that he is viewing a virtual space (Martirosov & Kopeček, 2017) and be present in the classroom. This also avoids the cost of expensive gadgets.

For this study were used three case studies from domestic spaces designed by the architect Frank Lloyd Wright, namely the *Taliesin House* (1937), the *David and Gladys Wright House* (1952), and the *Norman Lykes House* (1959). The chosen cases are three domestic spaces iconic in the lifework of the architect and represent the interpretation of the author in designing for dwelling, mainly in terms of the relation between interior and exterior, the effect of the artificial/natural light and shadows, and the interior flow of the space. The research involved 20 students, divided voluntarily into two groups. To each group was presented a session divided in three parts which included the traditional method and the VR method. The evaluation of each part was made by an anonymous online survey. The results show that the VR method was more captivating, however both methods allowed the students to understand well the discussed content. This pilot study reinforces the importance of developing VR content about Interior Design projects to support Interior Design History teaching.

## 2. LEARNING INTERIOR DESIGN HISTORY: THREE CASE STUDIES USING TRADITIONAL EDUCATION AND VR

Usually the teaching of the history of design uses texts accompanied by two-dimensional images (i.e.: photographs) to present and contextualize the discussed topic.

In the last decades several studies have shown that virtual reality is helping in the learning process for different areas, as well as the emotional reaction to what we are experiencing



are fundamental to forming memories. (Mills & Araújo, 1999; Roussou et al., 2008; Christou, 2010).

## 2.1 THE THREE DOMESTIC SPACES BY FRANK LLOYD WRIGHT

The three fundamental parameters above mentioned to interpret the spaces designed by Lloyd Wright are aligned with the arguments of both Zumthor (Zumthor, 2006) and Pallasmaa:

“Altogether, the most essential architectural qualities seem to arise instinctively from the designer’s sense of his/her body rather than conscious and intellectually identified objectives. In addition to – or as part of – his intuitive grasp of the significance of atmospheres, Wright was also instinctively sensitive to other architectural qualities, such as the reading of the essence of the landscape, its dynamism, rhythm, materiality, history and hidden primordial narratives.” (Pallasmaa, 2013, p. 53)

The architect Frank Lloyd Wright is known for his lifework dedicated to design for dwelling and the chosen project represents the intention and concern when designing for domestic spaces. One of his most known residential projects is the Fallingwater House (1935), where he deepened the philosophy of organic architecture. During his lifework he designed more than a thousand projects (more than five hundred of them were built). Designing for dwelling (with more than three hundred built projects) allowed him to think, explore and interpret many ways of living in a domestic space. The architect usually not only designed the interior space but also objects and furniture to include in the project.

The Taliesin West (Figure 1) was built in 1937/1938 and was more than a house, it was a complex design by the architect to become his

winter house and his studio where he received and helped to teach students and architects. Nowadays it is a UNESCO World Heritage site and National Historic Landmark (Taliesin West, n.d.).



Fig. 1. Exterior of Taliesin West. Source: Lidija Grozdanic - <https://inhabitat.com/frank-lloyd-wrights-school-of-architecture-faces-loss-of-accreditation/>

As Pallasmaa describes “The Taliesin West complex rests in its Sonoran Desert setting as if it had been there before the landscape” (Pallasmaa, 2013). The building and the interiors (Figure 2) are almost utopic and ambivalent, where the structural stone confine weight and robustness defining spaces with a purpose and the design makes them like it is part of the landscape. The windows define the interior space and extend it to the outside, and the skylights in the interior is now part of a togetherness. The natural light is captivated mainly by high windows or skylights strategically designed, creating on space moments of “impenetrable darkness of shadows and the purifying light filtered through surfaces of stretched white canvas” (Pallasmaa, 2013).

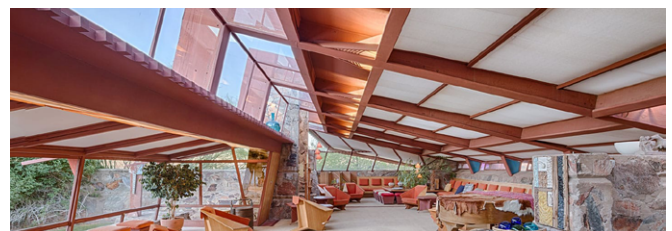


Fig. 2. Main living room of Taliesin West. Source: Frank Lloyd Wright Foundation - <https://franklloydwright.org/taliesin-west-3/>

David and Gladys House (Figure 3) was built in Arizona in 1952. This house was a special order, it is a house designed for the son of the architect and is titled “How to live in the Southwest” (David & Gladys Wright House, n.d.a). This is the first of three spiral design houses projected by the architect Frank Lloyd Wright. This project is the domestic precursor of the Guggenheim Museum (1959), where the experimental spiral guides us through continuous interior flows of the space.



Fig. 3. Exterior of David and Gladys House. Source: Frank Lloyd Foundation - <https://franklloydwright.org/site/david-wright-house/>

The house was the most innovative residential work of the architect. The access to the interior is made by a ramp that follows to the roof, and the building is raised on columns, promoting a better view from the interior. The building is constructed in custom concrete blocks torn by large windows across the facades, connecting the interior with the exterior. These large windows are also key elements to provide natural light, carefully designed. For example, as it is possible to observe in Figure 4, the kitchen window is divided by the exterior ramp (that gives access to the roof), in this case the ramp is also the shade for the countertop.



Fig. 4. Kitchen of David and Gladys House. Source: Antoine Bootz - <https://www.galeriemagazine.com/frank-lloyd-wright-house-arizona-restored>

The Norman Lykes House (Figure 5) was the last house designed by the architect.



Fig. 5. Exterior of Norman Lykes House. Source: Frank Lloyd Wright Foundation - <https://franklloydwright.org/update-frank-lloyd-wright-designed-lykes-house-for-sale-by-no-reserve-auction>

The project started to be designed in 1959 just before the architect died and it was just possible to finish because the architect shared and discussed his thoughts and content with the architect John Rattenbury (one of the architects that worked for him). Rattenbury was able to finish the technical drawings as Frank Lloyd Wright intended (Rattenbury, 2004).

The house was completed in 1967 and is the last spiral house designed by the architect. The building was carefully designed to be part of the landscape, privileging the south view for the city. The main room is the living room and it is almost like an observatory (Figure 6). All the south



windows are split in high (above the horizon line) to create a shade from the sun, making possible to obtain the best natural light and shadow for the space (Pfeiffer, 2006).



Fig. 6. Living room of Norman Lykes House. Source: Frank Lloyd Wright Foundation - <https://franklloydwright.org/update-frank-lloyd-wright-designed-lykes-house-for-sale-by-no-reserve-auction>

## 2.2 OBJECTIVES

The main goal of this research is to evaluate if virtual reality can be a valid tool to support teaching and learning in Interior Design History course. In this study VR teaching methodology was compared with the traditional method of teaching, by evaluating 1) the level of interest of the students in Interior Design History and 2) their level of empathy and satisfaction in each method.

## 2.3 EVALUATION PROCEDURE

For operational reasons, the study was divided into two sessions, carried out in two consecutive weeks. In each session participated 10 students, randomly selected from a total of 20 students,

and the sessions had a duration of 45 to 60 min. The students attended the third year of Interior and Equipment Design Degree from Applied Art School of Castelo Branco, Portugal. Table 1 shows the sequence of each session, divided into three parts being each one followed with an individually and anonymously online survey.

Table 1. Sequence of each session.

### # Sequence of each session:

#### Part I Explain the research study; Informed Consent for participate in the study.

Q – 1stpart Survey about the interest in Interior Design History.

#### Part II Simulation: traditional method.

Q – 2ndpart Survey about empathy and satisfaction with the traditional method.

#### Part III Simulation: VR method.

Q – 3rd part Survey about empathy and satisfaction with VR method.

The session started with the presentation of the study, procedure and goals – Part I.

In Part II, representing a classic lecture, the three spaces were presented by the instructor orally, supported with a PowerPoint presentation (Figure 7).



Fig. 7. Sample of some slides created for the session. Source: Authors

This presentation of 37 slides was organized according the following steps:

1. Objectives presentation of what is to observe in the session: relations of interior/exterior, artificial/natural light, and space flow;
  2. Frank Lloyd Wright (life and career);
  3. Presentation of the three case studies;
  4. Taliesin West, 1937: intentions for the project; plan, sections, and photographs of several rooms that are part of the complex;
  5. David and Gladys House, 1952: intentions for the project; plan and photographs of several rooms explaining the relation between them;
  6. Norman Lykes House, 1959: intentions for the project; plan and photographs of several rooms explaining the relation between them;
  7. Summary and brief discussion on observed fixtures and their importance in the space.
- Part III of the session represents the VR as tool for

learning. Each student received non-immersive VR cardboard glasses (Figure 8) and used their own smartphones with connection to internet. Three online links were sent by email that allowed them to virtually visit each domestic space. After explaining what each link meant, students were asked to open the link of Taliesin West case study (Taliesin West Virtual Tour, n.d.) and insert the smartphone inside of the VR glasses (Figure 9).



Fig. 8. Virtual Reality Cardboard Glasses. Source: Authors



Fig. 9. Student open the virtual tour link before inserting their smartphone in the VR Cardboard Glasses. Source: Authors

The virtual tour began (Figure 10) by explained to students how they needed to proceed to be able to visit the space (if they looked down they had access to the plan, and if the fixed the look on the blue dots they were able to move forward). Then, the instructor gave some directions and contextualization's about what it was intended to observe. For the other two spaces the procedure was the same. The students took out the smartphone from the VR glasses and changed to the other link (David & Gladys Wright House, n.d.b; Frank Lloyd Wright's Last Design, n.d.) and then inserted the smartphone again to navigate virtually in the other spaces.



Fig. 10. Photographic documentation of the experiment. Source: Authors

The survey consisted of three parts. The first part was answered in the final of the first part of the session and was related with the level of interest of the students in the course. The second part was answered in the final of the second part of the session and intended to evaluate the level of empathy and satisfaction with the traditional methods. The third part of the survey was applied in the final of the session and intendeds to evaluate the level of empathy and satisfaction with the VR as a tool.

The data gathering, of comparative analysis data, about the level of interest was based on "The Individual Interest Questionnaire" (IIQ) for cognitive engagement and on-task behaviours and attitudes (Rotgans, 2015) about the relation with the students and the Interior Design History course. The survey was composed of five statements (Table 2) and the objectives were to understand whether the students were interested in the history of design and whether they considered it important for their future career.

Table 2. Interest Level Survey.

#	Statements
Q1	I'm a person interested in design history.
Q2	Outside of class / school context I am interested in reading and researching Design History.
Q3	I'm always excited about Design History class.
Q4	Since the beginning of the course I have always been interested in Design History.
Q5	Design History is an important course for my professional career.

To evaluate the empathy and satisfaction, a survey based on "Interpersonal Reactivity Index" (IRI)

was used (Davis, 1980; Davis, 1983; Pulos et al., 2004). The survey had a total of nine statements, four about empathy (Table 3) and five about satisfaction (Table 4).

Table 3. Empathy level survey.

#	Statements
Q1	The method applied to present the contents was interesting and captivating.
Q2	The exposed content will stay in my memory for a long time, as if I had visited the space.
Q3	The exposed content became dense and boring.
Q4	The method applied allowed us to better understand the content and return to them if necessary, independently.

Table 4. Satisfaction level survey.

#	Statements
Q1	The method applied made me feel involved with the class/session.
Q2	I am pleased with the class/session because it allowed me to understand the presented project and their interior space.
Q3	The theory classes could all be like this one.
Q4	I was able to understand well all presented contents.
Q5	I am pleased with how class/session explored the contents of the interior space.

For the empathy evaluation, it was intended

to understand students' self-perception and engagement with the teaching method, and how the two teaching methods could facilitate learning and memorizing the presented contents. Regarding the level of satisfaction, it was intended to analyse whether the applied method increased students' involvement and whether they were able to explore the content by themselves. As instrument of measurement was used the Likert Scale (0-5), meaning: 1 – Strongly disagree, 2 – disagree, 3 – Neutral; 4 – Agree; 5 – Strongly Agree. It was also given the possibility to choose N/A (not applicable) in case of the student did not want to answer.

## 2.4 RESULTS

As explained above in this research it was intended to evaluate the level of interest, empathy and satisfaction, regarding the traditional and VR teaching methods, and it counts with a total of 20 answers. The following figures illustrate the results obtained in the survey.

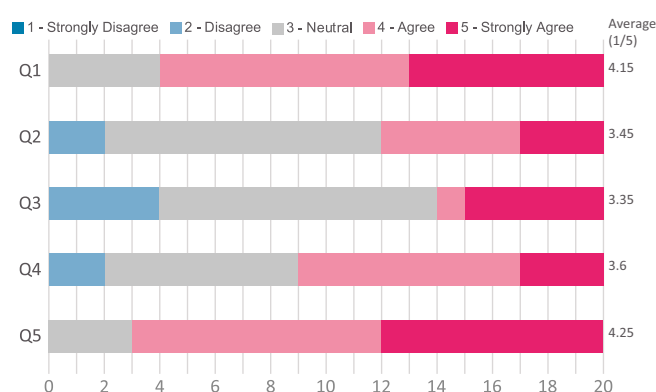


Fig. 11. Results of interest survey in Interior Design History course, scored with the Likert Scale.



Analysing the result about the level of interest (Figure 11) in interior design history the answers was 15% disagree, 45% are neutral, 23.3% agree and 18.3% strongly agree (average % – Q2, Q3, Q4). However, they recognize that history is important for their future career (Q5 – 85% answer positively) and in general they are interested in history (Q1 – 80% answer positively). Nonetheless, the excitement for the class had the lowest rating, mainly with neutral answers (for Q2, Q3 and Q4 approximately half the answers were Neutral).

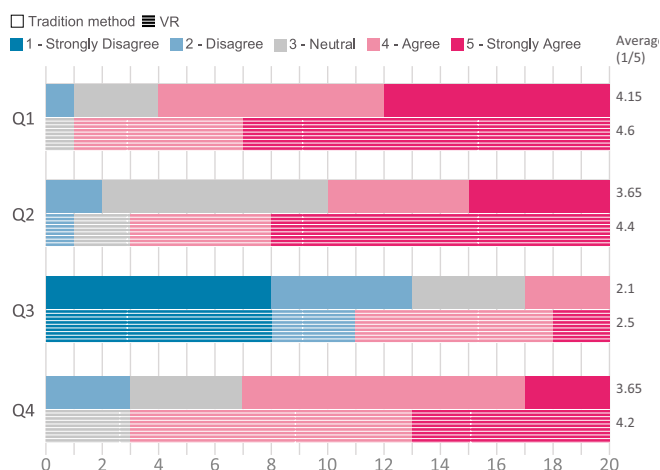


Fig. 12. Results of empathy survey in Interior Design History Course, scored with the Likert Scale.

When comparing the two methods considering the level of empathy, the results showed that the students agree that VR as learning tool is more captivating and interactive than traditional method, with 95% versus 80%, respectively, of positive answer (Figure 12, Q1). In average all the answers have a higher score more positive answer for the VR method.

As it can be observed in Figure 12, for Q2, 12 students “strongly agree” that VR method will produce content that will stay in memory, in comparison to traditional method only 5 students “strongly agree” with the statement. However, regarding “Q3 – The exposed content became

dense and boring” only 15% of the students agree with the statement in traditional methods compared to 45% of the students in VR method. Regarding Q4 “The method applied allowed us to better understand the content and return to them if necessary, independently” 17 students answer positively to VR method versus 13 students to traditional method.

So, it can be considered that VR is more captivating and can produce long memories that could improve the learning process, also allowing a better understanding of the presented content.

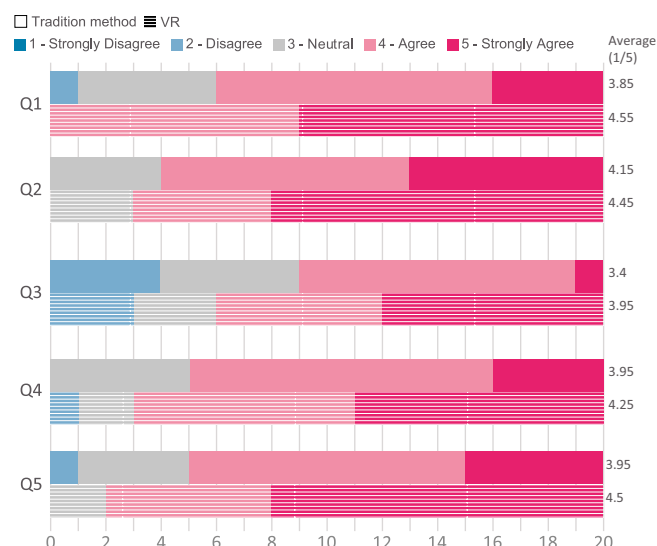


Fig. 13. Results of satisfaction survey in Interior Design Course, scored with the Likert Scale.

About the level of satisfaction, a higher score is noticeable for the VR method. In Figure 13 more answers with “strongly agree” are evident for VR, so we can say that the students feel more involved in the session/class using VR with 100% of positive answer and only 70 % feel the same in traditional method (Q1). In terms of understanding and explore the content/interior space (average % - Q2, Q4, Q5) 86.6% of the students agree positively for VR method against 76.6% with the traditional method. Nonetheless both methods were satisfying for students to

understand the project and the content explained (Q2), although VR was more pleasurable to explore the content (Q5).

### 3. DISCUSSION AND CONCLUSION

VR is already used as a learning tool especially for activities that involve some human risks or that simulate expensive and difficult situation, like medicine and spatial training. The value of using VR as a teaching tool and learning about interior design history is enormous, because it will allow the students to live through their own eyes the past and became critical about what has been done and what can still be done. This pilot project allows us to understand the students' receptivity and the possible applicability of our future research for the PhD project. Based on the showed results and the observed reactions the VR as the tool to support teaching is more engage however without a structured platform that can collect all the addressing topics is hard to maintain all group focussed. Because VR, on the opposite to the expositive traditional method, involves interaction the students were more aware and interest on the exposed topics. We agreed that VR as a tool could benefit the ways we taught however it is important to provide students with theoretical and scientific bases that will support their learning. We think that, nowadays, it is already possible for VR as a tool to be a complementary support for traditional teaching methods, however, not only do students need to make this transition, but also teachers and schools.

### 4. FURTHER WORK

In this evaluation it was possible to identify the limitations about using the students' smartphones and the online access, where the instructor was not able to control the hardware or software. In terms of evaluating, in the future, it is important to make also a quantity and quality measurement about the students' learning for both methods over an extended time.

### ACKNOWLEDGMENTS

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# Coworking in fashion design, through online collaborative learning

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## Abstract

This paper intends to contribute with broader research about fashion design higher education in Europe. Its purpose is to investigate how collaborative, online learning would promote the coworking capabilities that fashion designers need to succeed in a sector that is fast-paced and globally scattered. A large number of multinational textile and clothing companies and upmarket brands and businesses structure the fashion system. The competitive pressure forces this system to continually change and adapt their development processes to satisfy consumers worldwide with innovative, value-added products at competitive prices. The demand for specialised products and weekly collections increasingly requires fashion design teams to communicate and coordinate their work efficiently, despite physical or time constraints. This paper hypothesises that coworking, supported by collaborative, online environments, can give fashion designers and brands a competitive advantage since it can put together teams of diverse professionals with different backgrounds, and that is free of the time and costs taken with displacement. However, it requires that learning environments should provide collaborative, online experiences. Hence, fashion design learners develop capabilities to work in big teams, to get access to a multitude of knowledge and competences, to find answers globally and to adapt fast when facing diverse markets. So, resorting to a prior study about heutagogical principles associated with fashion design education (Guedes & Buest, 2018c), this study aimed to identify coworking initiatives in fashion design courses and programmes offered online. The results demonstrated that those courses did not promote online cooperation, team-oriented learning, team-building capabilities, which ultimately would prepare designers to work collaboratively in developing products that could be 'globally appreciated.'

## Keywords:

**fashion design education; coworking; online learning.**

## 1. INTRODUCTION

The fashion sector is highly fragmented and formed by multinational textile and clothing companies and upmarket brands and businesses. Those companies and brands need to anticipate changes in an innovation-driven market and continuously adapt their development processes to satisfy consumers worldwide with original, value-added products at competitive prices. Furthermore, the demand for specialized products and weekly collections increasingly requires fashion design teams to communicate and coordinate their work efficiently, despite physical or time constraints. Other factors, like the development of digital technologies, unstable labour conditions, and scattered production locations, also boosted new, more flexible ways of working and new ways of working in teams. So, fashion professionals are, more and more, working remotely, as freelancers or consultants, collaborating with different brands, different design teams at the same time, and even cooperating with professionals from related sectors to develop conjoined products and collections. New ways of work would presuppose new ways of learning. However, there are significant discrepancies between the professional and academic fields, when analysing fashion design higher education in the light of a fast-paced professional landscape.

### COWORKING FOR FASHION DESIGN

"Coworking spaces are a type of serviced office whose members are usually comprised of independent or unconnected workers or businesses. Although these offices can also be rented out by corporate clients for one company, coworking spaces generally support a shared working environment" (Statista, 2018). The concept of coworking was first used by

theorist Bernard DeKoven to designate a community of people individually working together, and as a method that would facilitate collaborative work and business meetings coordinated by computers. Gandini (2015), Perriton (2018), and Waters-Lynch (2018) analyse coworking as a response to technological advancements in digital and mobile information systems and the uncertainty in the traditional labour landscape. Those socioeconomic conditions prompted coworking strategies because it can relate to less formal ways of working, enabling professionals to work virtually, independently of the location, flexible, hybrid, distributed, network, self-managed, team-based scenarios. Statista forecasts indicate that by the end of 2019, the number of coworking spaces worldwide achieves 22,000 and over 25,000 by 2020 (Statista, May 2019).

Five values are allied with the Coworking model: collaboration, with multiple sources of knowledge, openness through transparency and dialogue, community with members contributing and sharing their expertise, accessibility through virtual spaces, using technologies to promote interaction and sustainability, adopting a holistic and an ecosystem perspective. Although those values resonate with dislocated, flexible, and mobile context in the professional landscape, in educational settings such values tend to be ignored, which continues reinforcing formal practices and organizational control. Coworking values and collaborative approaches also resonates with the design practice, since many times design projects develop in an informal, uncontrolled or unexpected manner, and designers rely on the expertise of their team, or extended partners, with different knowledge. Similarly, design courses, especially in fashion, maintain an isolated perspective of creation "celebrating the individual, elevating it-people, developing the exception... in a society hungry for consensus and altruism" (Edelkoort, 2017).

This study adopted a coworking approach not focused on the physical location but related to the need and willingness to communicate. To foster coworking in learning environments that surpasses the boundaries of the classroom, learning communities must have opportunities to connect and then work collaboratively.

In the case of fashion design, coworking would provide advantages to professionals that have to face a complex and dispersed system of production and distribution. Likewise, coworking would offer a non-linear learning experience, based on collaboration and negotiation among learners, which would enrich the 'conversation' with the project, from the problem research and definition, the ideation of possible solutions and the resources needed to reach them, to the materials selected, and the development of the prototypes.

"Collaborations demand far less individual investment in learning and therefore accelerate the process of experimentation in combining different kinds of expertise. Once the participants have learned some of the objective facts surrounding the issue, they begin to explore the subjective opinion of other members of their community." (Ma, 2008, p. 19).

Ma's (2008) study on design communities fostered by Computer-Supported Collaborative Learning (CSCL) demonstrated that while communicating, learners exchanged ideas and re-sources and created a sense of community around the learning activities, enriched by the online environment. Brindley, Walti, and Blaschke (2009) also support that the interactive learning process starts with communication, moves to collaboration, cooperation, and potentially can end up in a community. Besides that, the authors consider that connectedness offers the opportunity for learners to negotiate their perspectives with a broader community, promoting reflective thinking, preconceptions ruptures, and openness. This interaction among people is what fosters

contextualization (Narayan & Herrington, 2014), stimulates creative dialogues, and innovative answers, and sustains collaborative projects. This is why, this paper views coworking as resulting from a collaborative community of knowledge, connected and accessible through mobile, digital, or virtual technologies and settings. Part of broad research about fashion design education in Europe, this paper hypothesizes that fashion design courses, less attached to traditional education paradigms, especially those delivered online, would benefit from coworking with dispersed teams.

The next section presents theoretical and methodological approaches, relating the coworking values with the fashion design practice and collaborative perspectives. It also presents and describes the fashion design courses analysed, and discusses the results in the light of the theoretical approaches. The last section concludes the study, identifying its limitations, and exploring future opportunities that might contribute to the knowledge in the sector.

## 2.METHODOLOGY

This paper presents a part of broader research on fashion design education. It is centred in Heutagogy as a theoretical approach to sustain coworking learning environments, prompted by collaborative working/learning experiences and supported by "emerging technologies" Blaschke (2012, p. 61). The values of coworking (collaboration, openness, community, accessibility, and sustainability) align with heutagogical principles (learner-centred and learner-determined; capability; self-reflection and metacognition; double-loop learning; non-linear learning and teaching) and with fashion design learning principles (FDLP - reflective thinking, research and interpretation, creativity and imagination, collaboration and communication,

complexity and uncertainty) identified in previous studies. The present research is focused on fashion design courses online and considered that a learner-centred perspective, fostered by collaborative learning environments and technologies, create meaningful and transformative learning experiences, and promote professional/learning coworking communities. This system educates self-determined fashion professionals to employ anticipatory thinking and prospective behaviour when facing market uncertainty and to acknowledge that, especially in the fashion sector, every new project requires new knowledge and competences. So, resorting to prior studies about heutagogical principles associated with fashion design education (Guedes & Buest, 2017; Guedes & Buest, 2018a), we analysed fashion design courses offered online, within European Higher Education Area (EHEA), and tried to understand their approach to coworking or collaborative practices in their learning strategies. The courses selected in this paper fulfilled a set of criteria, previously established in the previous studies: they must be offered online, by an accredited and recognised HEI, as the first cycle in the Qualifications Framework (QF-EHEA), with a focus on the designing of fashion products (fashion design).

Other criteria submitted the HEI to professional and academic rankings (CEOWORLD, Fashionista, Business of Fashion, ARWU, CWTS Leiden, QS, THE, US-News). The two programs selected were from Italian HEI. Table 1 presents two courses analysed, and both are delivered exclusively online:

Six course units were selected from each course and were further analysed. They focused on designing fashion products since these demand from designers intensive coworking activities, sustained by collaborative actions. Following the concept developed in previous studies (Guedes & Buest, 2018b; Guedes & Buest, 2019), learning experiences (LE) develop through the dynamics between the online learning experience (O-LE), or the materials and resources available, presented either by the tutor / HEI or by the learners and external collaborators and the collaborative online experience (C-LE), which reflects the possible interactions that may arise during the activities completion. The learning experiences (LE) identified in each course unit were analysed to understand the level of the collaborativeness of learning activities and workload. Learning assessments (LA) were also analysed since they were considered as part of the learning experiences.

Table 1. Fashion design online courses analysed

Country (EHEA)	University / Departments	Fashion Design courses	Documents analyzed
Italy	<i>Università Telematica San Raffaele Roma</i>	<i>Triennale Architettura e Design Industriale, indirizzo Moda</i> (BA in Architecture and Industrial Design, Fashion pathway)	course website, program description, and 4 course units plans;
Italy	<i>Università Telemática E-CAMPUS (UniE-Campus), Facoltà di Lettere</i> (Faculty of Letters)	<i>Corso di Laurea in Design e discipline della moda</i> (BA in Design and Fashion discipline)	<i>Regolamento didattico</i> (Academic regulation) and 2 course units plan.

### 3. RESULTS

The results demonstrated that those courses did not promote online cooperation, team-oriented learning, team-building capabilities, which ultimately would prepare designers to develop products that could be 'globally appreciated.'

Triennale Architettura e Design Industriale, indirizzo Moda (Bachelor's in Architecture and Industrial Design, Fashion pathway) at UT San Raffaele.

The program, as stated on the website, combines the Italian Design and entrepreneurial strategies aiming to prepare students for the complexity of the fashion sector. It contemplates six areas: fundamentals of fashion, industrial design, interior architecture and design, communication media, economics and juridical, anthropological, and sociological theories. The students access the campus through a name and password provided individually. In the platform, students find learning materials (online and off-line), virtual classes, weekly activities (forums, online collaborative activities), weekly announcements, supplementary teaching resources, a mailbox

for exercise delivery, and a section for tests. A virtual environment (live session) is activated in pre-established dates, through a system that integrates a text chat, a video, and a virtual whiteboard. It allows files sharing or taking real-time tests. One of the desired professional profiles is to be 'able to work in a group, to operate with defined degrees of autonomy, and to fit quickly into the workplace.' As indicated in the program, the students achieve this competence through the use of asynchronous (emails, forums) and synchronous (live sessions) tools that promote collaborative online learning among the students, tutors, and teachers, as well as face-to-face workshops.

Table 2 presents the design of the analysed four fashion course units, from the 2019/2020 Fashion Curriculum, to identify collaborative, coworking evidence in their institutional structure. Those four units belong to the 1st and 2nd years. In the third year, the unit studied 'Fashion Design Laboratory 3', did not present the full content, and was not considered.

Table2. Course units analysed from the BA in Architecture and Industrial Design, Fashion pathway.

	Course Units CFU (crediti formativi universitari)	Description	LE (O-LE and C-LE)	LA
Year 1	'Concept Design' 8 CFU	*Design thinking as a method to solve design problems. *Understanding products social, technical and morphological aspects.	*40hs video-recorded lessons *8hs interactive educational activity (4hs for virtual classrooms, 3hs for exercises and revision, 1h for self-assessment, 15min each).	*3 exercises, papers delivered weekly, *Personal portfolio. *Oral or written exams *Virtual training sessions
	Fashion design laboratory - 1 8 CFU	*fashion basics and trends to production of clothing. *Prerequisite for 'Fashion design laboratory-2'.	*40hs of teaching provision (DE), video-recorded lessons *8h of interactive teaching (DI)	*Review of introductory lessons and practical exercises.
Year 2	'Design methodologies for fashion' 8 CFU	*Understand the concept of fashion, apply design methods and techniques to develop a project from a brief.	*40hs video-recorded lessons. *8hs interactive educational activity (4hs for virtual classrooms, 3hs for exercises and revision, 1h for self-assessment, 15min each).	*Practical tutorial evaluated in 10 points.
	Fashion design laboratory-2 8 CFU	*Fashion on fashion system	*40hs of teaching provision video-recorded lessons. *8h of interactive teaching (DI).	*Review of introductory lessons and practical exercises.

Corso di Laurea in Design e discipline della moda (Bachelor's in Design and Fashion discipline) at Università Telematica E-CAMPUS (UniE-Campus) As stated in the Academic Regulations (Regolamento Didattico del Corso di Studi Design e Discipline della Moda), the course aims to provide adequate theoretical and practical basic training allowing professionals to operate in the various sectors related to fashion, from the product conception to its development, production, and promotion. The professional profile does not indicate collaborative, group work, or team-based capabilities directly. However, it foresees communication as an essential skill, which is promoted through interactive works and laboratory activities, resorting to wikis, c-map, and forums available either in the course units' lessons or in the exams. Course units are defined as 'di base' or fundamentals, 'caratterizzanti', or specific and 'affini o integrative', related or integrative. A student-centred approach is ensured by learning methods, like live meetings, collaborative

and participatory, as well as independent, self-managed studies, training activities through synchronous mode in the traditional classroom (teachers seminars) or in the virtual classroom (webinars) and through asynchronous activities available in the e-learning platform, (media library, exercises, selfassessment tests), both under the guidance of the online tutor (TOL) and the teaching staff. The service chart previsions a flexible learning path through the drafting of a personalised study plan for each student and the possibility to choose the examination type (Art. 4 a., c., in the service charter and Art. 17 in the Academic Regulations).

Table 3 presents two units analysed, from the 2019/2020 curriculum, to identify collaborative, coworking evidence in their educational structure. They reflect the project development and are defined as Caratterizzante, or characterising disciplinary, from the field of 'music and entertainment, techniques of fashion and artistic productions,' following classi dei corsi di studio, and with the scientific-disciplinary sector ICAR13, Industrial Design.



	Year 2	Year 3
Course Unit CFI-J (crediti formativi universitari)	Industrial Design-I 6 CFI-J	Industrial Design-I 6 CFI-J
<b>Description</b>	48 lessons divided in two parts: *2-21 . innovative materials in fashion; *22-48. project development of a technical sport accessory: a mountain backpack. Knowledge of material components to foster design ideas and focus on the product development phases. Prerequisite: Drawing 1, 2.	48 lessons divided in two parts: *2-3. strategic factors that contribute to the design of fashion products. *4-48. project development, "technical" (sports glasses) or "precious" (jewel) accessories. Knowledge of virtual product modeling methodology applied to the product development phases, focusing on innovation. Prerequisite: Drawing 1, 2 and Industrial Design2.
<b>LE (0-LE and c-LE)</b>	*Teaching provision (DE), through video lessons and virtual classrooms; *interactive teaching (DI). Self-assessment, through closed-ended questions. Formative assessments: documents or interactive exercises accessed via WikieCampus and Cmap and sent to the teacher for feedback.	
<b>LA</b>	60 min written exam or oral examination Part 1 - multiple-choice questions; Part 2 - open-ended questions; Exercises developed during the course unit contribute to the exam's final grade. Final exams take place in one of the eCampus locations.	

Table3. Course units analysed from the BA Design and Fashion discipline.

## 4. DISCUSSION

The graphics below represent the discussions on the results identified after analysing the four course units at the 'BA Architecture and Industrial Design,' Fashion pathway (UT San Raffaele), and the two units at the 'BA in Design and Fashion discipline' (UniE-Campus).

Activities are individualized and performed in isolation: individual studies, tests, exercises, consultation of the available resources, and self-assessment completion.

- At the course units analysed, activities do not promote collaborative work  
Activities are individualized and performed in isolation: individual studies, tests, exercises, consultation of the available resources, and self-assessment completion. This learning

approach creates a co-dependent relationship between learners and teachers/tutors since the primary purpose of the tasks is to achieve the institutional goals. Also, it seems that virtual classes are understood as a way to socialize and communicate, and that would be enough to activate a collaborative behaviour and then a coworking engagement. In this research, the coworking concept goes deeper than simple social interaction. It is defined as behaviour fostered by online environments when there is a need for different skills and knowledge to resolve a problem or to engage in discussions that are useful professionally.

- Technological tools are perceived to support collaborative behaviours

As understood in the present research context, collaborative behaviours occur when dispersed teams get together by the use of technological tools. These teams are built on competence and skills, not on geographical availability. Technological tools in online environments offer an enormous opportunity to develop coworking behaviours, through borderless and timeless online interactions, and content generation. Coworking is a behaviour fostered when there is a need to resort to different skills and knowledge of the (learning) community to resolve a problem or to engage in discussions that are meaningful individually and have professional use.

- At the online project-based courses analysed, students follow predefined goals, through a predefined and fixed curriculum  
In professional settings, fashion designers trigger coworking practices when they need to negotiate and discover how their expertise can contribute to a project. But, at the 'BA Architecture and Industrial Design, Fashion pathway' (UT San Raffaele), for instance, brief for the final, personal portfolio development is proposed by the teacher, disregarding a real-life problem identified in the

fashion sector by the learning community. Online learning could instigate learners to contribute with their skills, while reflecting on their progress, learning from their peers, sharing and testing project outcomes with the learning community, but also with their extended network, diminishing the gap between the learning and the professional environments. The learning experience, as the learning assessment, could promote teamwork, instigating learners to take risks and assume responsibility for the tasks for which they were responsible.

- The analysed units of the course are in the Italian language

Fashion designers are required to communicate in work teams scattered globally, and using a global language, then learning communities should not be limited by language. Online learning environments should be prepared to receive international students, which would promote a more productive experience and potentialize collaboration and coworking activities.

## 5. CONCLUSION

Working collectively for different brands and collections, fashion designers are sometimes responsible for only a part of an entire collection. Brands require different capabilities and specializations, ranging from cosmetic lines to accessories, footwear, and clothing, among others. Design teams must be built based not on geographical availability, but competence and particular knowledge. Their ability to work with and for people with different cultural and language backgrounds is keen for their practice. Multicultural and multi specialized teams of fashion designers give brands a competitive advantage since it can put together teams of diverse professionals with different backgrounds to face the risks and provide quick responses to



the challenges in today's business environment. This paper regards coworking, supported by collaborative, online environments, as a strategy to eliminate time and costs associated with personnel time and displacement, apart from enhancing the access to different levels of information, technologies, expertise which places it as a valid answer to the fast pace and complexity of fashion sector. Consequently, it is essential that online learning environments provide collaborative experiences and promote coworking capabilities, so fashion designers learn to work in large teams. Nevertheless, this study revealed that while online courses implement technological tools to work collaboratively, they did not reinforce coworking capabilities. Web platforms, webinars, forums, chatrooms, live classrooms, or video-lessons, per se, do not promote collaborative learning if the structure is still teacher-centred, not flexible, and distant from the market reality. As this paper demonstrated, online learning environments for fashion design although have the potential to promote coworking capabilities the studied courses do not use those environments nor implement an online learning dynamic able to allow students to sharing, and exploring new knowledges and competences. The learning systems implemented offer, as a result, low coworking environments with regard to fashion design.

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# The Haptic Experience of Jewelry Education Based on Sensory and Material Design

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## Abstract

Sensory design is widely discussed in various art fields, especially haptic experience. The studies in haptic design are rather rich, Bully wrote in his artwork “Tactus” that “each score is composed of numerous cells of braille and haptic notations that form an overall composition” (Tactus, n.d.). These cells can be explored by touch (using capacitive sense technology), with the tactile and textural patterns varying based upon the sound material they represent. This paper aims to discuss the expression of feeling in jewelry education, through different haptic experiences draw from embroidery stitches. A didactic activity was taken in Yanjing technology college (China), performed during the 2019-2020 academic year with 13 undergraduate students (7 males and 6 females) in their third year of jewelry study. The paper aims to discover the haptic effects of jewelry by exploring three embroidery stitches to present different haptic experiences. During the workshop, four emotional themes were provided: joy, anger, grief, and happiness. Students could choose subjective colors according to the theme expression, along with settled embroidery stiches. The visual and haptic results were compared and discussed, the students were also asked to describe in detail the design process, as a feedback of the effect of teaching. The final output was expected to be a students’ work display, along with a discussion of the value of haptic experience in jewelry design education word wide.

## Keywords:

**Jewelry Design, Haptic Experience, Multisensory Design.**

## 1.1 INTRODUCTION

Since the mid-1970s, jewelry design has already changed from material-lead design, to the expression of contexts (Li, 2017). However, the education of jewelry design in China remains an emergence major. Two kinds of didactic models appear in China: a comprehensive university of science and engineering, which sets up jewelry design courses, such as the China University of Geosciences; along with the art colleges, such as the Central Academy of Fine Arts (Li, 2018). Most of the teaching activities focus on practice and theory, with an absence of knowledge in the form and concept of design (Chen & Zhan, 2010). There are still holes remain to be filled, especially for design experience and in-depth inspiration. With the arrival of the experience economy era, the importance of sense has been widely recognized by society, be-called a new trend in design development. It is the time to explore the sensory characteristics of the body, whether to design the city, architecture, or daily necessities (Masayuki, 2003). Wen (2014) divided experience design into four levels, namely: sensory design, interaction design, emotional design, and personality design. He points out that sensory design is considered to be the first level of all design since sensory communication is the most direct way to connect jewelry and body (Wen, 2014). Meanwhile, Stenslie (2013) investigated that mobile haptic technology is able to present our various wearable haptic systems, such as mobile computing capable of producing high-order tactile percepts. Particularly see his artworks "The Blind Theater" (2009) and "The Ichihara Touch Tales" (2014) ([https://www.sohu.com/a/114182251\\_488954](https://www.sohu.com/a/114182251_488954)). Smith tried to create intriguing tactile surfaces by recognizing what naturally occurs in the wood and exploiting those qualities, such as mirroring wood patterns (Astfalck & Groups, n.d.).

Haptics plays an essential role in sensory design, as people can feel weight, temperature, softness, and hardness, along with the psychological reactions that arouse specific emotional manifestations. Haptics has been considered as the original emotion of jewelry design (Guo, 2012). Also, Spence (2011) emphasizes the importance of touch in product design, as the synesthetic correspondences could evoke tactile sensations through the visual and auditory senses (Spence & Gallace, 2011).

This study focuses on haptic experience in the education of jewelry, taking a seven-day workshop with students in jewelry design. By studying the stitch of embroidery (traditional Chinese handicraft) which brings the tactile quality, we aim to explore the emotional expression of touch in jewelry design, along with the didactic value.

### 1.2 IMPORTANCE OF SENSORY EDUCATION IN DESIGN

Single simulation not just evokes one kind of sense, all our senses work together. Riccò (2014) declares that the designer's job is to consider all kinds of sensory interactions while performing certain functions (Riccò, 2014). Merleau-Ponty (2000) emphasised the importance of the interaction of the senses, that human perceive in a total way with the whole being (Merleau-Ponty, 2000).

There are a lot of sensory applications in design works, in particular see Naoto Fu- kasawa's package design for simulating the texture and color of real fruits, as a re- minder of consumers' nature experience (Yu & Mao, 2018).

Institutions of art and design also contribute to the understanding of senses, such as Itten's practice of evoking the nature inside (Masson et al., 2013), and Moholy-Nagy's pedagogy of developing students' skills with visuals, texture,

movement and sound (Findeli, 1990). Synesthetic design, which is described as the “project that gives particular attention to the relationship, and coherence, between the sensations and which combines the contemporary meaning of synaesthesia” (Riccò, 2014, p.248), remains in an important position in dealing with the intersensory correspondences. Multiple didactic activities have been taken among synesthetic design, between audio, visual and haptic for visual communication (Riccò, 2009; Riccò et al., 2003), along with the study of taste and visual expression (Liu et al., 2018). It has been proven that co-working of senses significantly enriches the expressiveness of design, also reduces artificial and sensory inputs in unnecessary aspects. Meanwhile, the tactile emotion synaesthesia also discusses the nature effect of seeing soft texture as safe, and roughness as unpleasant and dangerous (Ramachandran & Brang, 2008). Sensory training not only could improve students’ ability of design, but also could enrich their creativity and lead them to express own emotions within design works.

### 1.3 JEWELRY DESIGN AND HAPTIC EXPERIENCE

One challenge design work faced, is that the current industrial production weakens the connection between visual and emotional cognition (Pallasmaa, 2012), and ignores the design value brought by the other senses. Indeed, visual is the main sense to affect our perception, but other senses such as haptics could also produce added value. (Riccò et al., 2003; Favre & November, 1979; Spence et al., 2014). What charms people most is not the physical objects, but the challenging progress of sensation, which brings pleasure through the experience with all our own body (Shao, 2012). Design of jewelry shares the same view, that it is not only to be experienced as a single visual

image, but also as the measurement of touch, and the clicking of sounds. Shao also thinks that putting on, presenting, even moving out the jewelry all present interactivities with the wearer, giving a further sensory stimulation of emotions. Among all the senses, haptic has wealthy applications in the field of art, also showing great potential combining with new technics. “Anarkik 3D” is a research project focusing on building 3D models with haptic devices (<https://www.shapeways.com/blog/archives/447-farah-bandookwalas-haptic-3d-printed-jewl-%20ery.html>), while Bandookwala uses 3D and haptic devices to explore new ways of designing jewelry. The work of Langendries gives the audience the impulse to be touched by studying the haptic feeling of animal fur, the length of the fur is different as a result of the laser cutting process, producing a different tactile experience (<http://www.103.be>, n.d.). Also, the “Sexual Healing” work by Nienke Helder allows women with sexual trauma to understand their bodies with haptic contacts, restore interest and security to sex (Nienke Helder Designs Tools for Women Recovering from Sexual Trauma, 2017). We choose haptics as the focus of the experience, since it is the combination of multiple simulations and emotions (Wang, 2014), along with its productive expression potential in jewelry design.

## 2. METHOD

Our study aims to explore the potential of emotional expression with haptic experience in jewelry, along with the didactic value in jewelry design. We guide the students to explore their feelings with an in-depth analysis of the relations between visual and tactile senses, also give a lead to their choices of haptic materials. Similar structure of exercise could be found within studies in synaesthesia, which deal with visual, audio and haptic experiences (Riccò et al., 2003).

Before the study, we analysed different tactile expressions, and chose embroidery based on the following reasons:

1. Embroidery has rich traditional cultural values and is the perfect embodiment of traditional Chinese hand crafts.
2. Embroidery stitches have controllable tactile experiences.
3. The material of embroidery is cheap, also easy to use.

The students from Yanching Institute of Technology (China) are in their third year, major in jewelry design. They have already finished courses about theoretical knowledge and practical operation techniques related to jewelry. Meanwhile, they have a deeper understanding of traditional culture and hand craft after the course "National Jewelry Design". This could be helpful to complete the task.

The stitches of embroidery are selected based on two demands:

1. The stitches must provide richness and variety of touches.
2. The stitches must be easy to learn.

Thus, we chose three traditional stitches of embroidery: backstitch, hemming stitch, and French knot. These stitches provide a change gradually from 2D to 3D, and also produce different textures to show various tactile experiences. Moreover, these stitches are easy to learn and master. During this study, we did not limit the color choice (neither the quantity), since color was not our focus.

## 2.1 DESIGNING THE TASK

The task was divided into four steps:

1. Short lecture introducing the concept of haptic design, mainly through examples of arts and crafts designed by artists and researchers, to deepen students' perception of tactile expression.
2. Introduction to the history of embroidery and three chosen stitches, the students were asked to practice until they could produce a nice visual presentation.
3. Thirdly, the students were asked to choose one theme from "joy", "anger", "grief" and "happiness" (four emotions that appear in traditional Chinese culture), then they were expected to consider the colors and the stitches related to the specific emotion.
4. As the output, students were required to design a bracelet by stitches, along with a presentation to introduce their design concept. The students were asked to explain the connection between the emotional themes they chose and the haptic expressions.

## 2.2 WORKSHOP PROGRESS

We found two problems during the students' learning processes. They had problem in creating the tactile experience, mainly because they lacked an understanding of sensory design, also being unfamiliar with the process of related design methods. Another problem was that they had difficulties in understanding the emotional themes. The students possessed a rather limited knowledge of design, along with the haptic output of transforming.

To improve the process, we added a course in between to help students understand and complete the design. Through scenario simulation and guided questions, we helped students first



Table 1. Proceeding of the workshop and tasks to be fulfilled

Step.	Task	Questions Proposed	Proceeding
1	Scene Simulation	"After the college entrance examination, you got an offer from your dream university. How do you feel? How would you describe your feeling?"	We formulate specific scenes to let the students frame the emotional feelings.
2	Form Visual Elements	"What color do you use to describe flying in the clouds?" "What kind of texture do you think joy has?" "What stitch do you choose to represent the feeling of flying in the clouds?"	While visualizing the concept, the students should consider four types of visual elements: colors, forms, texture, and stitch. For example, one student thinks "joy" could be understood as flying in the sky and touching the soft clouds.
3	Shape the Bracelet	/	The shape of the bracelet can be ordinary or innovative according to the needs of the design. For example, use the image of the cloud to have a wave edge.
4	Design Visualization	/	The students should present the design of their work by hand drawing, also mention the size, color, pattern, and stitches they chose.
5	Tactile Display	/	The students have to finish the work according to the design draft, experience the haptic effect and make the necessary modifications.

to walk through the expression of vision, and then transform the idea into tactile experience. Meanwhile, we helped them refine their designs through guided questions. The improved workshop progress is as follows, which takes the theme "joy" as an example (see Table 1):

### 3. DISCUSSION

During the workshop, students could produce a relatively complete and expressive work. Student Gong tried to use French knot and backstitch to express the emotion of "joy". During the presentation, she explained: "The cold weather always makes me sad, but it is also a joy to look forward to the warm weather." She selected the warm color yellow and red, along with the

backstitch texture to reflect the tactility of the sunshine, which expresses the expectation of warmth. She also used white color and backstitch to represent the cold weather. At the end of the bracelet, she used the French knot to show the wooly touch, which makes people feel comfortable.

Another student, Wang, explained her work as "Red bean is also called love pea. I chose the implied meaning of the love pea to express the joy of a wedding." The bracelet is white, embellished with red decorations as a symbol of both wedding dress in the west and good luck in the east. She used backstitch to show the silkiness as a symbol of joy when the bride touches the wedding dress. By using the French knot, the shape of the red bean could be simulated in a more 3D way. Student Qin selected blue and yellow as the



main colors and combined the backstitch to show the overlap of lines in different thicknesses, that brings a touch of grass. She mentioned: "Laying on the grassland gives people a feeling of freedom. I wanted to express the height and softness of the grass on the lawn through lines in different thicknesses."

According to the students' design work, it is possible to make several observations according to the theme, background color, stitch color, and stitch type (see Fig.1).



Fig. 1. Students' works under the theme "Joy".

We did a group reflection after the study, also addressing several points that could produce advice for such cross-sensory expressions. Students are likely to select familiar topics, such as "joy" and "happiness"; according to them emotions such as "grief" and "anger" are not so easy to manage. They are also more likely to choose easy acupuncture stitches to reduce the

difficulty of expression, rather than choosing the stitch that is most suitable. According to the study, the expression of touch is mainly expressed in the height and width of the texture, along with the tactile characteristics inherent in the material (such as soft and hard).

Students' works under other themes are presenting here (see Fig.2):



Fig. 2. Students' works under the other three themes (one theme per line): "anger", "grief" and "happiness".

## 4. CONCLUSION

From this study, we understand that students are unfamiliar with the haptic experience, they have limitations in understanding the expression of emotions by sensory design, which at some level affects the final output of the work.

As a suggestion, for teaching in jewelry design, we could consider problem solving and stepped questions to guide the students through

unfamiliar situations. For example, we can set up individual course exercises, such as shaping a texture, or exploring the stacking, and then put them together. Different textures can be proofed for comparison, so that students can feel how the haptic experience changes. Then, we proceed with the correspondence of colors, shapes and emotions, and finally implement the connection between touch and emotion.

From the perspective of design, sensory design works as a creative design tool, which does not only give jewelry multi-dimensional design possibilities and research value. Meanwhile, it is a high-effect research method and tool to explore and protect the traditional handicrafts. Material has its special sense of haptic, also, it was enriched haptic experiences by traditional handicrafts creates various textures. Hence, it would enhance traditional handicrafts' artistic value through combining haptic experience and emotion. In the process of touching the jewelry, haptic experience not only evokes sensory interaction but makes people have personal emotional experience according to their affective association and emotional transference.

Sensory design plays an important role in jewelry design education. On the one hand, one of the innovations of contemporary jewelry design is materials. The sensory design can explore the diverse properties of materials, increasing the expression of sensory experiences and emotions. On the other hand, the jewelry design education should focus on the jewelry semantic, especially in the multi-media times. Mastering the expression and experiences of sensory and the relationship between sensory and emotion would conduct and inspire students' thinking ability and explore their design potentials.

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# The attraction of Education: national stereotypes and study destination choice

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## Abstract

This article discusses the relationship between the constructs of image, national stereotypes and attractiveness of Higher Education (HE) systems, analysing the Portuguese case within the context of European Higher Education.

The increasing importance of academic mobility (as a consequence of globalization, political decisions and demand market) coupled with the sharp demographic decline, as well as the increased internationalization efforts of Higher Education Institutions (HEI) around the world and the general increase in global competitiveness has forced them, and their own regions and countries, to an increasingly strategic use of communication tools in an attempt to attract investment, resources and students to maintain and improve their position or, even, to survive.

The empirical research was based on a sample of 464 European students, from several HEI belonging to EDCOM network, from which Portuguese stereotype were measured - based on the Stereotype Content Model (Fiske et al., 2002) and its correlation with the intention of performing all or part of a cycle of higher studies in Portugal.

The implications of this study allows to understand and therefore design strategies aiming to promote attractiveness of the Portuguese higher education system.

## Keywords:

**Higher Education, Academic Mobility, Attractiveness, Country of Origin Effect, Country Image, National Stereotypes.**

## 1. INTRODUCTION

The current globalized world where goods and services are exchanged with virtually no restrictions or difficulties, brought a new paradigm and many changes on one hand in production and on the other in dissemination and promotion of these products or services, both within and outside the borders of each country. In this context, a country's image and national stereotypes are particularly important and have a leading role, since several studies show its importance when choosing and deciding to purchase and/or consume.

As most of the commercial activities, higher education also was not left out of this trend. Consequently, among other factors, the decreasing number of students, the reduction of financial resources, the development of new technologies, the fact that education is now seen as a commodity, the advent of globalization, the reality of this new knowledge economy and knowledge society and a competition with just about no borders, the phenomenon of internationalization of education has become a heavily discussed topic both in the Academy and within governments. Therefore, understanding the mechanisms of the international students choices, the most important factors in those decisions, the weight and importance of each one of them, as well as the relationship between their perceptions and choice decisions are very relevant to the Higher Education Institutions (HEI), but also to the regions where they operate and, ultimately, to their countries, since the flow of foreign students is an important source of revenue, contributing, in some cases, in a very sharply way to national economies.

In this globalization era, of open markets, and free and shared information almost without limit, countries have become authentic brands dealing and managing their communication

and marketing strategies just as if they were commercial companies, in order to increase the export of their products and services as well as attracting foreign investment and tourism.

Working as real brands, many countries are competing with each other for their share of millions of international students seeking experience and knowledge outside of their countries. In Australia, for instance, this sector is already the second largest source of revenue, after tourism (Shanka et al., 2006).

So, if knowledge is universal, if it is exchanged and traded internationally crossing borders faster than people or capital, it is understandable that both institutions (that produce and promote it), and countries want to attract the best students, teachers, researchers and resources. In this context, the question of image - or perceptions / mental representations created from the stimuli communicated by brands, organizations or entities, such as cities and countries - is one of the concepts identified as extremely important by modern organizations (Ruão, 2008). Therefore, the image study applied to higher education in an international context is relevant as a way to help raise awareness for this issue, study the influence of national stereotypes (in the dual role of national organizations and geographic brands) and better understand the mechanisms that generate the intention of studying in that particular country.

Moreover, literature has already stressed out that differentiating the right way to position yourself strategically and manage (improve or maintain) the dimensions that contribute to influence stereotypes can be key tools to change the perception of consumers, managers and investors, that no government can afford to underestimate. The authors postulate that the essence of a brand's magnetism is communication, perceived



here in its broadest sense. That is, this symbolic exchange that generates positive or negative impressions is, in itself, a producer of magnetism, or, in other words, the engine that runs attraction. So the question is whether they can, or if they are able to or if it is even possible to HEI and countries generate and / or control the magnet effect of their education brands through strategic communication?

## 2. THEORETICAL BACKGROUND

As Varghese (2008) reminds us, the sources of economic growth have changed over time: in the time of agricultural societies it was land; after that the capital took place when industrialized societies arose in and, finally, in this society of knowledge, attention is focused on the individual and its features and capabilities. That is, this change from industrial society to knowledge society, since the mid-century XX, brought new challenges to human communities as a whole, but especially for the individual (focused on their intellectual ability and their knowledge) that sees the growing emphasis on progress, creativity, innovation and entrepreneurship. And since knowledge, by definition, is universal, it is natural that the institutions that produce and promote it have been gaining an ever greater role, as they are the most visible sector of the process of creation, preservation and systematic dissemination of knowledge (Kehm, 2011).

Although universities have always attracted international students, until the 1990s what we had was an “international education”, that is, a set of little defragmented activities very little related between them. Since then, with globalization and the assumption of Education as a commodity (since it was included in the rules of GATS in 1995), a new reality has emerged.

In this global arena of transnational education, the analysis of the preferences of international

students has become, therefore, a very important subject of study, not only for HEI involved in internationalization strategies, but also for local, regional and national authorities concerned in promote their territories as study destinations (Cubillo et al., 2005). Indeed, there are numerous governments that have shown, in an emphatic manner, the economic benefits of higher education. This has become a global commodity, with many countries “selling themselves” as expert nations in research and education in order to strengthen their competitive position in the global arena (Stier, 2004, p. 91).

After all, the benefits of international student mobility is going well beyond the financial returns: it brings highly qualified individuals to the territory, increasing its quality, cultural level and prestige. Hence, many countries assume as a strategic objective, the development of incentives to attract foreign students to their HEI. To name just one example, since 1990, United Kingdom doubled the number of international students (Binsardi & Ekwulugo, 2003), and, in the same period, Australia has tripled (Varghese, 2008). In Portugal, the number of incoming students, by geographic regions, according to the OECD, are the following: Africa, 34.9%; Latin America, 29.5%; Europe, 28.5%; Asia 4.8%; North America, 2%; and Oceania, 0.2%. Of course the historical relationship, linguistic, cultural and even economic relation that Portugal has with many African countries and, in another continent, with Brazil - which is the country with the highest percentage of students sent to the country: 26.8 % - explains part of this numbers. Among the European countries, the order is Spain 9.3%, France 2.7%, Italy 2.4%, UK 2.1%, Germany and Poland, 1.8% and Belgium 1.1%. As for the outgoing mobility of Portuguese students, UK leads the table (30%), followed by Spain (15.7%), France (14.5%), Germany (8, 1%), Switzerland (6.1%), Belgium (3.9%), Brazil (2.7%), and the Czech Republic and the Netherlands with 2.1%



each, as the most representative destinations. Whether due to geographical proximity, social life, associated costs, knowledge and familiarity, geography and climate, or the image one has of a destination, among others, the location is recognized by many authors as a decisive factor when choosing the HEI. And within this article, we will examine some constructs per se that encompass several of these factors: the Country of Origin Effect (CoO), the country's image and the national stereotype.

The Country of Origin Effect is explained in a very simply way, through a metaphor, by Papadopoulos & Heslop (1993): This is for a product, the same as the profession reveals about a person who was just presented to you at a party, i.e. we use this reference to contextualize and make upon it a value judgment. Commonly identified by the label "made in ..." is an extrinsic clue that consumers use to assess the quality of products whose result has implications in the attitude towards these countries and the products offered by them. However, in a globalized world, this concept of country of origin is increasingly difficult to operationalize. Products are often designed in one country, manufactured in another and sometimes assembled in a third, so often different of the nationality of the brand (Chao, 1998; Han & Terpstra, 1988; Insch & McBride, 1999). For services, this point gains a greater importance since the intangibility requires consumers to make assumptions, so the nationality of the service providers have a greater impact on their beliefs. As for the country's image, Askegaard & Ger (1998, p. 53) define it as "a scheme or a network of interrelated elements that define a country, a structure of knowledge that summarize what we know of a country, together with its evaluative meaning or affective scheme." Simply put, we can further define this phenomenon of mental representation as a set of mental associations - emotional and cognitive - that individuals relate to certain countries. These associations

include geography, natural resources and tourist attractions; people; history; culture; language; economic and political system; social institutions; infrastructures and famous people; among others. Here, differently from the traditional studies of CoO that enable researchers to analyze the consumer preferences for products from a particular country against others (Roth & Diamantopoulos, 2009), studies of the country image - in the higher education environment - help to explain the reasons behind these preferences. The image of the country seems to play a key role in choosing the international study destination because, in the absence of knowledge of the courses, facilities, etc., students use this construct to form value judgments. Regarding the National Stereotype, it was firstly introduced in the social sciences with the book "Public Opinion" by Walter Lippman in 1922, where it is referred as social representations that each individual develops about himself and others through "images in their heads". Therefore, these are images that arise in our mind when we think of certain social groups (Pereira et al., 2002), that is, a cognitive scheme used in social perception when processing information on others. Basically, stereotypes are beliefs we have about the attributes, characteristics and expected behaviours of certain group members and can be explained by the principle of cognitive economy, i.e., we organize our knowledge so that we can access much information possible with minimal cognitive effort (Lima, 1997, p. 171).

## 2.1 STEREOTYPE CONTENT MODEL

In all social interactions, upon encountering out-group members, several authors posit that people need to understand immediately: the intentions (good or bad) of the others, i.e., do they intend to harm me?, and, secondly, the ability to perform those intentions, i.e., are they capable of harming me? Cuddy et al., 2008; Fiske et al., 2007).

These two core dimensions of general stereotype content, Warmth and Competence answer these questions.

Moreover, as Fiske, S. T., Cuddy, A. J. C., Glick (2007) wrote, 82% of the perceptions of all daily social behaviours is based on these two dimensions (cited in Wojciszke et al., 1998). That is, when people spontaneously interpret the behaviours or form impressions of others, Warmth and Competence together largely determine how people characterize them. The Stereotype Content Model (SCM) is a model that offers a way to look at stereotypes (Fiske et al., 2002), based on three assumptions: (a) Two-dimensional hypothesis, which puts perceptions on a map with two axes, defined by the dimensions Warmth and Competence, outcoming a representation in four quadrants; (b) the hypothesis of Mixed Stereotypes, which states that, in most cases, we combine the opposite of both dimensions, i.e. high Warmth and low Competence or vice versa; and (c) the Socio-structural hypothesis, which argues that a higher perceived level of Competence corresponds a greater sense of power or Status of this group, as well as a higher level of perceived Competition represents a lower sense of Warmth. This is the model that we used in our study.

### 3. STARTING QUESTION, METHODOLOGY, ANALYSIS MODEL

As a result of the presented literature review, we advocate in this study that national stereotypes generate expectations, which, in turn, influence perception and social judgments, and have direct influence on the attraction of a given location, while option choice as a study destination. In this sense, we start with the following question:

*“How does the stereotype of Portugal influence the attractiveness of the respective higher education system to European university students?”*

For the study of stereotypes was used SCM model (Fiske et al., 2002). At the same time, and as a result of the literature review, the authors decided to include several other factors identified in the literature as relevant in the choice of study destination, and grouped into three broad groups - personal, social and academic - in order to realize its importance the attraction, as well as their relationship with national stereotypes. The research scheme is shown in Fig. 1.

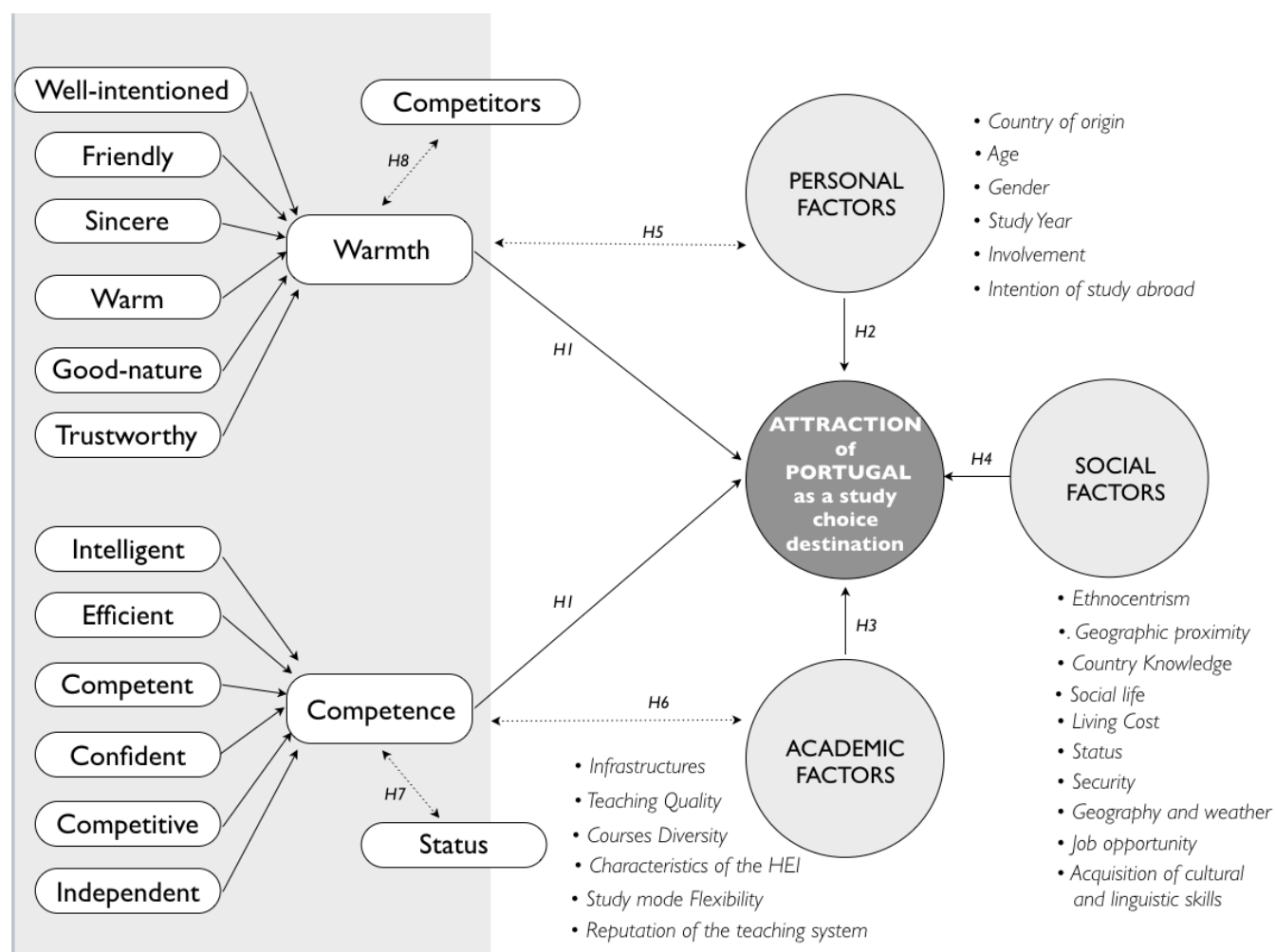


Fig. 1

For this study, we used a convenience sample of students belonging to EDCOM (European Institute for Commercial Communication Education), a European network of HEI exclusively from the communication field (marketing, strategy, branding, design and advertising), which has 39 members from 15 European countries. The directors of each HEI were previously contacted and informed of the framework, scope and importance of this study in the context of European academic mobility and subsequently, we sent them the digital survey to distribute among their students. We chose to collect the data electronically because it is easier to reach to

all countries, it is faster and cheaper, and because it facilitates the subsequent statistical treatment; We used English, because it is considered the universal language (Benzie, 2010; Ha, 2009; Wilkins & Huisman, 2011).

The survey had a first version that was tested with 50 foreign students that used to live in Lisbon under the Erasmus program, and after which were corrected some inaccuracies, redundancies and we changed some of the wording of the questions. After collected all inquiries, they gave up as valid 464 participants, which was considered a sufficient number for a convenience sample. Due to the high geographical dispersion of the universe, the survey was carried out online, and in English, as it is now considered the

“international language” (Ha, 2009).

For the measurement of variables, it was decided to use a modified Likert scale of five points, as it is widely used in Social Sciences, especially in surveys of attitudes, opinions and evaluations (Gunther, 2003). After completing the questionnaires, the data were processed using the statistical data treatment software SPSS - version 21.0.

To check internal consistency and scale validity, Cronbach's alpha and Pearson R. correlation coefficients were used.

#### 4. PRESENTATION OF RESULTS

In the Portugal's perception analysis, all the items that measure the Competence dimension, were evaluated above the average, with scores between 3 and 4, highlighting the “confident” features, “skilled” and “intelligent” with the highest scores, and “efficient”, the smallest. About the Warmth dimension, the items were scored higher than Competence, with some of the items to overcome 4 as average, such as the characteristics of “friendly” and “warm.” Although all average values are above the midpoint of the measurement scale for all items, we highlight “sincere” and “reliable” characteristics as the least popular.

Regarding the perceived Status, the average figures are superior to “good education” perceived, where the average value is higher than the midpoint of the measuring scale. As for the items “prestige of jobs” and “economic success”, the values are below the midpoint. That is, globally, European students perceive the Status of the Portuguese below the average. It is our belief that the low score on the perception of economic success is linked to the economic situation in Portugal at the time data were collected, widely reported fact and known in Europe.

Regarding the level of Competition that

respondents perceive about Portuguese people, it is very low. This is also explained in large part by the fact that all participants belong to the same big category, Europe, hence the level of competitiveness is smaller. That is, although the nationalities are different, there is a kind of feeling of sharing common geographic territory, values, culture, among others, which creates a sense of belonging to the same group (Cuddy et al., 2009). When self-evaluating, European students also classified all relevant characteristics about Competence, with values between 3 and 4. However, in general, the items with higher scores are “smart” and “competent” respectively, and the features that received the lowest scores are “honest” and “confident”. In the Warmth dimension, the mean values also lies between 3 and 4, with all the items being scored with values greater than the midpoint of the measuring scale. Despite the very small difference between the various features, the highest scores went to the features “reliable” and “good-natured” and the least popular were “sincere”, “friendly” and “warm”.

Regarding the Portuguese academic factors, the scores of most items are higher than the midpoint of the measuring scale, with the exception of the point concerning the “reputation of the education system.” This should deserve special attention, for three main reasons: 1. Reputation is a key factor in the selection criteria of HEI; 2. It works as risk reduction mechanism, which in the case of international students is essential; and 3. the reputation is a set of organizational associations that take a long time to change.

The second lowest factor was “research capacity”, very little above the midpoint of the scale. If we take into account that this is an area of excellence for the Academy, a factor of great weight in international rankings, and a very prestige element, we easily realize its importance.

As for the better evaluated aspects, we find the “diversity of courses,” followed by “quality of the

teaching staff”, “facilities” and “flexibility of the study format” in this order, despite having similar values.

In the self-assessment of academic factors of their own countries, the European students rated all items with scores between 3 and 4, with the higher score for the “diversity of courses”. In the second and third place, and in the opposite direction of Portugal, we find the “research capacity” and the “reputation of the education system.”

When we look to the importance of social factors in the choice of the study destination, all ten factors have had a positive note, with the item “acquire cultural and linguistic skills” presenting a score above 4. The following items were “security”, the “social life”, the “costs of living” and “language”. Considered less important are the “knowledge / familiarity with the country” and finally, “geographical proximity”.

When we asked about the intention of studying abroad, 81% said yes, which proves that participate in a study abroad program goes far beyond the mere acquisition of knowledge or academic skills. However, 45% consider unlikely or very unlikely choose Portugal as a study destination. In our view, poor perceived quality of the Portuguese HE, is certainly one of the reasons contributing to this.

## 5. DISCUSSION OF RESULTS

Our research proved the existence of a positive correlation between the stereotype of the country and the intention to go there to study. In this context, we can say, as suggested by Chattalas, M., Kramer, T., & Takada, H. (2008), that Portuguese institutions should stimulate and enhance the image projected through the different factors that make up both constructs, in order to promote and increase the attraction of the Portuguese higher education towards international students.

It is also significant to analyze the relationship between European students that Portugal receives and their stereotype about Portuguese people. The students that Portugal receives are: Spain (9.3%); France (2.7%); Italy (2.4%); UK (2.1%); Germany and Poland (1.8%) and Belgium (1.1%). Since Italy and Poland do not have HEI belonging to EDCOM, they were not included in this study. In the other four countries analyzed, the values are above the midpoint of the measuring scale and with minimal differences, so we cannot conclude a direct relationship between the stereotype and the actual enrollment in Portuguese HEI. In our opinion, the high number of students from Spain is directly related to the geographical proximity and, in the case of France and Germany, especially, but also the UK, with personal affinity, as a consequence of the high rates of emigration of Portuguese citizens for these countries. In fact, we are probably in the presence of students in mobility rather than international students, that is, it is possible that they are returning to their home country to study. Interestingly, UK, Spain, France, Germany and Switzerland are also the countries where Portugal send more students with 30%, 15.7%, 14.5%, 8.1% and 6.1% respectively and, we believe, due the same reasons.

As for the academic factors, the proven correlation with the intention of studying in a particular destination, come in line with most studies (Hagel & Shaw, 2010; Mazzarol & Soutar, 2002; Schimmel et al., 2009), particularly the items “reputation of the education system” and “perceived academic quality.”

About reputation, it is still important to note that, when comparing this evaluation with the scores obtained in the evaluation of the Competence dimension, we realized that the six countries that scored higher the reputation of the Portuguese education system, four of them also scored with the highest average the dimension Competence. As for the evaluation of the remaining Portuguese

academic factors, the values follow the same pattern of the reputation: in the top half of the table we find Romania, Turkey, Bulgaria, Croatia and the Czech Republic. As for the self-assessment, Belgium, Netherlands, Switzerland, Norway and Denmark stand out as the ones that best self-evaluate, i.e., there is an exchange position with the countries mentioned above. At the intersection of evaluation of academic factors of their own countries with the intention of studying in Portugal, we found that for five of the six factors analyzed, the lowest rating (1) has a direct correspondence with the highest average probability of studying in Portugal, so we can conclude that one of the factors that motivates students to study abroad, can be the lowest assessment made of the academic factors in their own countries.

As for social factors, it is surprising the unexisting correlation between the intention to study in Portugal and items such as the “acquisition of language skills and cultural” and the “geography and climate.” The first one because it contradicts all previous studies and literature review, and the second by its contradiction to the exploratory interviews with foreign students in Portugal. Having proven the relationship between the national stereotype and the intention to study in Portugal, the Portuguese HEI, but also the national authorities, should brandish arguments that potentiate the most valued factors, and try to modify the less positive perceptions.

This study also revealed that on average, most European students consider themselves more competent than the Portuguese people, but less affective. However, countries such as Spain, France, Bulgaria, Denmark, Turkey, Romania and Croatia evaluate the Competence of the Portuguese people with higher scores than those with which they self-evaluated. Perhaps this shows an opportunity to explore in order to enhance the attraction of students from these countries.

But when we evaluated the Warmth, the evaluation of the Portuguese people is greater than the individual self-assessment of all countries, without exception. Although this dimension has a lower correlation with the intention of studying in Portugal, it was proved its existence and influence, so reinforcing this belief through communication activities, will benefit Portugal image as a whole and also stimulate the attraction of students.

Another conclusion of this study relates to the confirmation of the relationship between the dimension Competence and the level of perceived Status. Thus, it may will suggest that efforts should be made to promote the Status of Portuguese people, since an increased perception of this factor is directly implicated in increasing the perception of Competence, and this, in turn, has a strong influence on the decision of choosing the study destination.

We suggest communication supported in examples showing successful Portuguese cases, disseminating more and better HEI that arise in international rankings, articles published in newspapers and magazines of reference, research with real benefits for people, products and projects resulting from works or partnerships with Portuguese HEI, are, among many others, only a few examples that can serve as a lever to boost the perceived Status of the Portuguese higher education.

Finally, we believe it would be useful to analyze the stereotype of Portugal with potential foreign students from outside Europe, since the majority of foreign students attending our HEI are from Africa, immediately after Brazil, the major “exporter” of students to Portugal. Although the language is the main reason that justifies these figures, there is a whole set of historical and cultural factors that enhances and stimulates the relationship and giving rise also to the way that Portugal and the Portuguese people are seen



by the citizens of these countries. Most of this students, contrary to the European students, come in a different mobility logic - normally longer, more engaging, and paid, so with greater economic benefits for the country.

Moreover, with the increasing global competition, Portugal must guard the guarantees of this flow of students, under penalty of start to losing them gradually to other geographic regions and countries. To do this, one must know well their attractiveness, realizing the weight and importance attached to each of the social and academic factors relevant in deciding the choice of study destination, and follow the evolution of perceptions of these audiences. It can be done through imaging studies and evaluation of the stereotypes, and finally, through developing strategic actions, also at the level of communication in order to manage and improve these perceptions.

## CONCLUSION

Higher education is, like it or not, a worldwide business, where “HEI operate and work their expressiveness through communication, in a competitive market logic and clear economic purposes” (Ruão, 2008) and the HEI do not have another way to survive, unless increase their capacity to attract. Attracting more resources, more investment, better teachers, better researchers, and, of course, more and better students.

Despite the decision process and choice of students be complex and multidimensional, in the case of international choice, the location factor proves to be crucial and decisive at the time of decision making. Whether by direct relation to the costs, either by geographic proximity, social life and surrounding environment, geography and climate, either for safety or even the perceived image of the destination, the location of the

campus seems to be decisive in the choice of students.

Moreover, the stereotype of the country is fundamental in this decision process. Based on the assumption, confirmed by extensive literature, that mental network of the affective and cognitive associations that individuals have about certain countries (country image) has a direct influence on the evaluation of products and services they produced, and having proven, too, that the stereotype of a country is bounding the way it is perceived and has direct influence on the relationship of intent with this country and their citizens, we argue that the study of these beliefs is therefore essential for multiple industries, as in this case, higher education.

A better understanding of how countries and their citizens are seen by foreign students will benefit, then, various stakeholders in this sector. Realizing better how they are perceived, different actors can design strategies to address the less positive situations, improving the dimensions less well evaluated, and/or enhancing the most valued, making their higher education more attractive and more competitive in global market.



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# Wisdom Transfer: The infographic study on the individual legacies from retired academics in art and design higher education and research.

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## Abstract

The work presented in this paper is part of the research project "Wisdom Transfer (WT): Towards the scientific inscription of individual legacies in contexts of retirement from art and design higher education and research".

Considering that, in Portugal, art and design research has only recently been validated as a scientific discipline, it can be argued that the available scientific heritage precedes the formalization of these disciplines - and, consequently, resides in an older generation of researchers who led a first moment of transition from practice to academia.

Due to the very advanced age of the scholars of this generation, all this wisdom and experience is in danger of being lost. The WT project aims to investigate, register and legitimize all this academic, cultural and artistic heritage.

In the first phase of the work, a group of 30 art and design retired academics were selected to be individually interviewed in order to collect testimonies and life stories within the academy, both as students and as lecturers.

Considering the results of these interviews, the purpose of this study is to analyze all the information, synthesize it and present it in an infographic structure.

Subsequently, it is intended to compile these infographics and present it on a website, in order to facilitate access to all interested parties, especially current art and design students.

## Keywords:

**Infographics; Academic Retirement; Art and Design; Education and Culture**



# Design Methodologies in the Context of Internship in Industrial Companies

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## Abstract

Master courses dissertations can be focused on technic or scientific research, can be a monography or an industry internship. Design methodologies and design project supervision in industry internship context require an attentive preparation and development, considering a) the student's profile and competencies, b) the company's design management strategies and industry characteristics (technologies, products, and markets), and c) the final design project goals in the context of the post-graduation program learning outcomes. Industry internships tend to be relatively short (3-4 months) and the students face a complex work process in an organizational and human unknown environment. Scientific and industry supervisors' tasks are to be carefully defined, and students must have clear goals and well-planned work program in order to allow the overall experience to be positive to all participants and contribute to structure students' knowledge and project development experience. Design higher education graduation and post-graduation programs benefit from industry/company internships and it essential to define the methodologies that will contribute to maximizing the quality of final results to all parts: students, higher education institutions and companies. The paper presents three case studies of product design internships in two shoe industries and one furniture industry in North Portugal. A methodology was developed and tested, and the paper presents the complete process, from design projects goals definition to final product presentation. We discuss the three cases and present conclusions on the developed methodology.

## Keywords:

**Design, design methodologies, design higher education, design graduation and post-graduation programs**

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# Introducing additive manufacturing learning in design courses: an empirical study

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## Abstract

Additive manufacturing (AM), also known as 3D-printing, widely used by the companies as a rapid prototyping tool to produce models in different stages of design process has become, in the last few years, one of the technology trends of Industry 4.0. Additive process capacity to produce end-use functional products allows the manufacture of small batches of customized products with construction advantages, such as complex geometries and lightweight optimized design shapes (Kietzmann, Pitt & Berthon). Compared to the conventional manufacturing processes, AM offers to designers new opportunities and strategies for innovation in product design (R. Hague et al., 2003). However, designers' lack of knowledge about AM was pointed out as a barrier to adoption of this emergent technology as a manufacturing process (Williams et al., 2009; Spallek & Krause, 2018). Designing for AM (DfAM) includes understanding AM processes and materials, enabling designers to acquire additional knowledge, skills and competences to take advantages of the unique AM capabilities. Aiming to prepare future design professionals to deal with this new manufacturing paradigm, it becomes crucial to integrate AM technology at higher education Design courses. We argue that this effort should be concentrated in project-based learning curricular courses, with a strong practical component and emphasis on the direct experimentation in DfAM. The paper describes an empirical work undertaken at a Portuguese university with undergraduate design students. Firstly, a preliminary study was conducted within university context, with 2nd year Design students, during a design project where they were encouraged to use the available AM equipment and take advantages of AM potential while designing artefacts for a learning space. The information gathered from the preliminary study enabled the identification of DfAM topics to explore in the following case study. The case study took place in a polytechnical school (belonging to the same university) with 2nd year Product Design and Technology students. In this case students received a project brief forcing AM technology as main manufacturing process to design artefacts aiming body protection and inspired by nature. Taking into account the opportunities to design allowed by AM technology, the introduction of AM intends to observe how students explore AM creative space and develop innovative functional products. Different data collecting methods were used, including focus group to listening students' perceptions about the inclusion of AM in design projects, project notebooks observation, audio records collected from



interactions between students and teachers during the design AM project, among others. Throughout the design project development, students identified AM advantages like complex geometries or customization to incorporate in final products. Throughout the project, as they faced AM technical constraints, students had to readjust their design and product features to guarantee their manufacturability through AM. Additionally, selected AM artefacts resulting from student's projects were analysed by specialists from different areas such as Product Design, Mechanical Engineering and Material Engineering, selected according to their research area. From the preliminary study two artefacts, produced in polylactic acid (PLA), printed by the most common AM process, Fused Filament Fabrication (FFF) were selected. Concerning to the case study, two printed products were evaluated: one was printed in Stereolithography (SL) and the second was produced by Robocasting in a flexible material. The four artefacts were evaluated by applying an Evaluation AM Product Matrix regarding the capabilities of additive manufacturing reported on technical literature. The main conclusions reveal that although students recognize the advantages of additive manufacturing in product design, they show difficulties incorporating AM benefits into their own product design and therefore generating innovative and disruptive concepts that take full advantage of AM unique potential.

**Keywords:**

**Product design, design for additive manufacturing, higher education**

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# Sprint to Pacing: to the 50K Finish Line Intentionality in Contextual Learning

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## Abstract

The Art and Design field has gone through many transformations due to the rapid development of technology, information overload, and the ever- changing landscape of our every day; from being a commodity supported by capitalist practices, we have transitioned into experiential spaces where art and design hold immense power in reshaping and building our imagined futures. Although the World has now become a global community of virtual experiences, we, as educators, need to maintain the relevancy of our instruction both globally and locally to enhance students' learning experience and wellbeing. Research shows that mental health issues in college students have spiked in the last few years; the ACHA-National College Health Assessment II (ACHA-NCHA II) 2017 report shows that around 25% felt exhausted, overwhelmed, and hopeless in the 12 months previous to the survey (ACHA, 2017). Through empirical research, we found that students taking 4 to 5 courses simultaneously lacked the focus needed to go in-depth into any provided material, which heightened their stress level and, consequently, lowers their performance. When designing and adapting curricula in a variety of groups, cultures, and contexts, there is a tendency to disregard the environment in which new generations have grown and the ways in which learning manifests in our day to day interactions. In a series of self-reflections, students reported feeling exhausted, drained, unmotivated, and burn out after one month and a half into the semester; acknowledging that high-stress levels hinder the learning experience, and that optimal learning happens when connected to positive emotions (Krashen, 1982) can have great impact in our teaching approach. Since pleasurable learning and a sense of achievement gives the amygdala a resting time for neurotransmitters to recalculate (Willis, 2007), it is important to deliver relevant content in a structure that provides space for incubating ideas and reach insights. This research paper presents a case study of a curriculum adaptation of the Parsons First-Year program TIME course to a 12-day Bootcamp for First Year students in the Graphic Design track at Altos de Chavón, the School of Design, an Art and Design school in the Dominican Republic, affiliated with Parsons. Since curricula development, pedagogy, and cultural contexts have an effect on our students' performance and overall learning experience, this curriculum entails both in-context pedagogy and explorations of new digital technologies through an intentional curriculum design approach. The aim of this new educational model is two-fold: first and foremost, to lower students' stress levels by providing the necessary resting time, an incubation period, if you will, to process new knowledge and practice self-care; second, to engage students deeply and intentionally by using a Project-based Methodology (PBL) supported by relevant and authentic materials align with students interests, cultural backgrounds, and needs. In order to develop the structure of this pilot course, we used a 50K marathon training model where athletes undergo high-intensity workouts (short strides



and intervals) to build endurance and progressively transition into low-intensity training for long-term development (Roche, 2019). This framework is meant to envision a new educational model that can open up access to global communities while being relevant to the communities to which they serve while fostering students' cognitive endurance. We found this approach to be beneficial to students' academic performance, in both the quality of productions and in amplifying their voice and self/social identities, and in preparing them to become cosmopolitan citizens of the world. In a series of debriefs, students reported feelings of achievement and success by having produced high-quality projects in such a short amount of time, and how they were able to apply gained knowledge in subsequent courses.

**Keywords:** First-Year Program, Design Education, Educational Model, Contextual Teaching

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# Track

## Design for Communication and Branding

*Communication design can well be framed as the heartland of effective communication. Brands are the result of a communication design exercise and their impact on lifestyles, either in terms of behaviour change or adaptation, ways of communicating, or one's own perception of the human condition and the world, is well established. On the other hand, research fulfils the purpose of questioning, understanding and transforming the world. Such positioning shapes the central question for this track: How can brands engage with ground-breaking communication design to transform the world we live in for the common good?*

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# Chapecó's urban art: a contemporary semiotic study on urban expressions and imaginary.

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## Abstract

The present paper is dedicated to expose a current research on semiotics and urban art in Chapecó, Santa Catarina, Brazil. This research is supported by the state of Santa Catarina and the Unochapecó University. Niemeyer (2010) says that “the product, in addition to practical, aesthetic and usability functions, has significant function. The product diffuses cultural values and characteristics within its scope.” The cultural values and characteristics presented in Chapecó's urban art is an ocean waiting to be explored and the ephemeral character of urban art is also something worthy of attention. Our research intend to clarify the meanings hidden behind urban art, producing cultural and academic knowledge and enrich the semiotic studies in Chapecó. Following Santaella's methodology of analysis, which is based on Peirce's theory, we are currently analysing the first images collected from the city walls and that is what we are presenting in this paper. Our intention with this research is to analyse and registrate before it's too late.

## Keywords:

**Urban Art, Semiotics, Chapecó.**



## SEMIOTICS: CONCEPTS AND PERSPECTIVES

Semiotics is the study of signs that builds the structure of languages. A sign is something that represents something else. For example, the famous painting by the surrealist belgian painter René Magritte (1898-1967), *The Treachery of Images*, which shows a pipe and below it the sentence “this is not a pipe”, in french “Ceci n’est pas une pipe”. The painting is just a representation of a pipe that is not actually there, but is being expressed through the image Magritte painted on a canvas. The semiotics investigate meanings behind the representation of signs.

In Santaella (2003), the author presents briefly some aspects of soviet semiotics and Saussure’s semiotic theory, in order to show that Peirce was not the only one working on a theory of signs back then, though she dedicated most of her career to Peirce’s theory and the path she opened with it for the semiotic study in Brazil is where we intend to lead the current research through. Charles Peirce’s theory originally divides his semiosis in three categories: Firstness, Secondness and Thirdness. The firstness is a moment where the qualities of a sign hit the interpretant senses for the first time. Let’s take the Magritte’s painting example once again. The first time someone look at the painting is when the firstness happens. Before one realizes it is a pipe on the canvas, even before one realizes it is a painting there is just colors and stains hitting one’s eyes. Firstness lives in the mind level. The secondness on the other hand takes place in our world through the matter. Secondness is the relation between a sign that is now in a physical form and the interpretant. It’s the moment when one recognize the object in the painting as a pipe or the painting itself as a physical object. The thirdness happens when the interpretant cultural background have an

influence on the interpretation. It’s not just the senses and qualities working to give meaning to a sign anymore. The cultural baggage, the time and space where an interpretant finds itself and the context where the object exists, all of these spheres together build the concrete meaning. In this moment one finally understands Magritte painted an image of a real object on a canvas and the canvas itself is an object displayed on a wall at the Los Angeles County Museum of Art.

Santaella (2005) divides the semiotic theory into three mainly perspectives: Qualitative-Iconic perspective; Singular-Indicative perspective and Conventional-Symbolic perspective. According to her, the “semiotics is necessary when one realizes that there is no communication or even achievable thinking without the mediation of signs.” (Santaella, 2003). The qualitative-iconic resides in the firstness dimension. In this point of view the analysis is focused on the qualitatives aspects of a sign, some of them are visible such as colors, textures and dimensions, but some are more abstract like softness and strength. (Santaella, 2005). In the singular-indicative point of view the analysis investigate the references outside the message, where the message (sign) wants us to look at. All of this happens in the secondness dimension. In the conventional-symbolic point of view Santaella propose the analysis of social conventions restricting the interpretations of a sign. For example, a red stop sign only works as a message because there is a social convention that everyone understands and accept that sign means to slow down. In other words, a conventional-symbolic sign have the exactly same interpretation among people that shares the same culture or live in the same society. Santaella’s methodology in semiotics study is currently what we consider the best way

to investigate our objects in order to build the image and imaginary of urban art in Chapecó.

## CHAPECÓ CITY

In order to situate the city of Chapecó in the present time and space we will present a brief history of its urban space. Until the late 19th century the west region of Santa Catarina was predominantly occupied by native Kaingang and Guarani Indians. With the arrival of colonizing companies in the early 1900s, the natives were divided between those who were forced to leave the urban perimeter that was being built there and those who were involved in the business of logging and Mate extraction, most of them being used as cheap labor (D'Angellis, 2006). Treated unfairly, according to Facco, Lemes and Piovezana (2008), "the space where the city of Chapecó (SC) exists today was the cradle of the Kaingang and Guarani Indians who roam in the city nowadays", therefore, the Indians have the right to be in the urban space, to live in the city".

We could say urban planning process began in 1931, when Colonizer Bertaso (the main responsible for the economic development of the city at the time and the person who brought from Rio Grande do Sul more than 8 thousand families to settle in the region) established an urban plan to organize the city's streets and avenues in a Cartesian format, with straight lines like a chessboard. (Hass, 2001).

According to Baldissera (2017), Bertaso had in his mind an european idea of city planning, taking as an example of urban space the wide avenues he had seen in France. This eurocentric conception was also structuring his ideas about society, after all, the families he brought to colonize Chapecó were mostly descended from Italians and Germans, and that is not a coincidence.

The 1940s and 1950s were times of substantial demographic growth due to the development

of wood extraction work in the region as well as the development of the city's commerce and industries. At this time, the Chapecó's urban structure was also changing, such as the widening of streets and avenues and the city's main square reformulation (Hass, 2007). In addition, the city was also beginning to stand out economically, with the foundation of big and powerful industries for agribusiness (Alba, 2002), a business field that would become years later west's greatest economic power.

With this industrial growth in the late 20th century, Chapecó became the largest city in the western region of Santa Catarina. In the 2000s, agents such as Chapecoense Football Association and the creation of a Shopping Center made Chapecó a very attractive city for people who came from nearby cities and other states to live in. Currently there is an urban and economic planning and development project with some social aspects being applied in the city, the "Chapecó 2030", the city keeps growing and the buildings are getting higher year after year.

The urban art is more present in the streets of Chapecó than ever, be it through well-known artists who have many paintings around the city such as Rodrigo Cardoso, Rogério Puhl and Grav, or through anonymous hands that leaves graffiti, wheat paste posters and many other forms of art scattered around the city streets and walls.

Exploratory Semiotic Analysis: Urban Art in Chapecó. In this item, we will explore and expose an exploratory semiotic analysis based on an excerpt of urban art in Chapecó. The theoretical basis used in this analysis is based on Santaella's framework: Qualitative-iconic, Singular-indicative and Conventional-symbolic. The methodology used in this analysis comes from an exploratory approach. To obtain the excerpt of this analysis, the researchers walked the city in november 2019, to search the first specimens of urban art expressions in Chapecó. This was the first of many "city walks" that will occur in the next two



years, until the collection of urban arte is enough to achieve the research objectives. The first examples are shown in the image below, which will be analyzed.

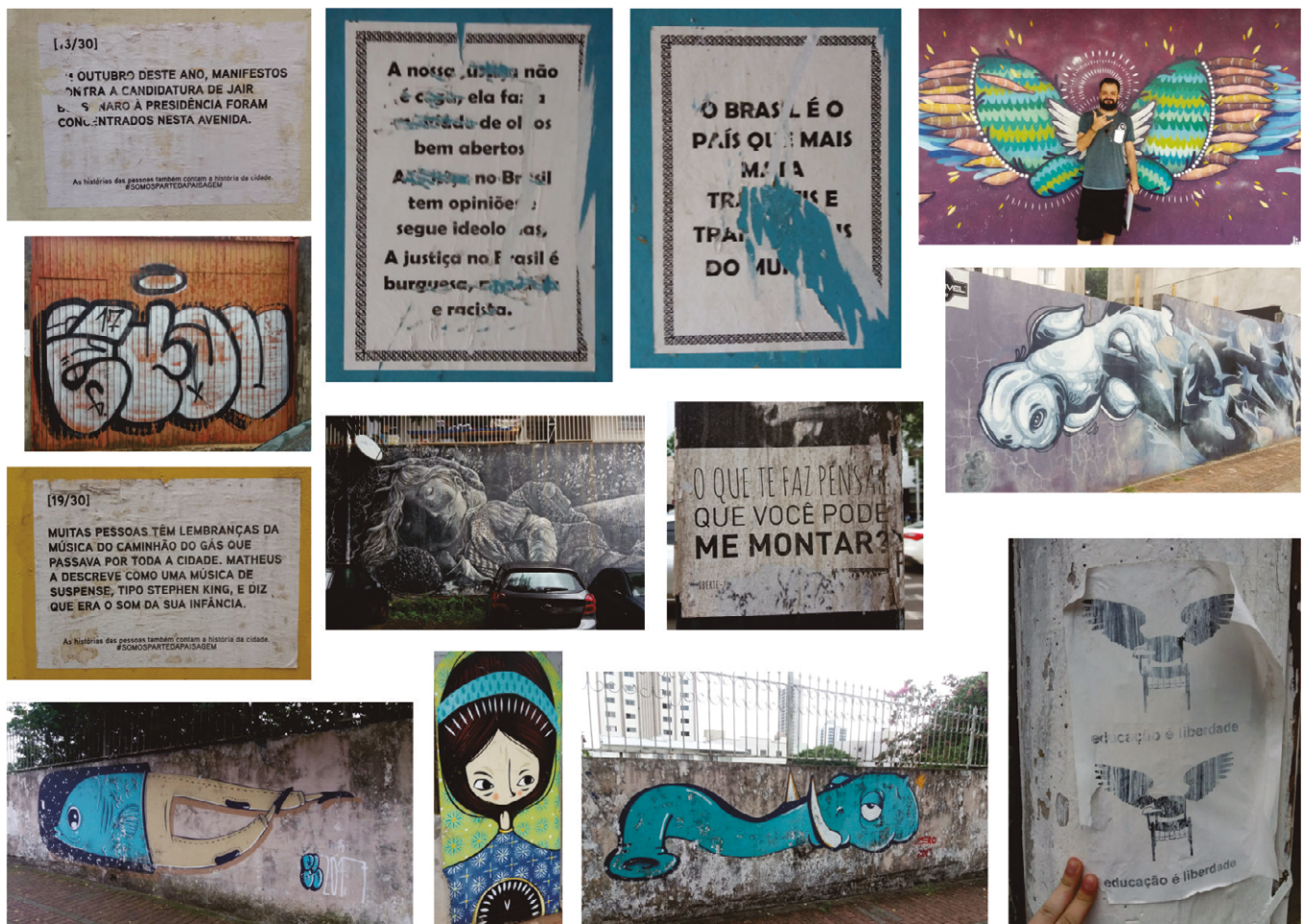


Figure 1. Mosaic of different expressions of urban art in Chapecó

## SEMIOTIC ANALYSIS.

### SANTAELLA'S FRAMEWORK

Lúcia Santaella's semiotic analysis is based on Peirce's trichotomy theory. The author divides its framework in three distincts instants: qualitative-iconica, singular-indicative and conventional-symbolic. The first category includes Peirce's

firstness, in which an object of study is analyzed by its first impressions, in terms of color, sense, feeling and iconic values. The second category addresses “secondness”, in which the analysis is done by terms of indications, facts, singularity and outer references. This includes analysing what the presented sign is referencing to, in a factual way. The third category covers a more symbolic view, analysing how the sign is presented and interpreted, from a social-conventional-status. Therefore, this framework will be used in this work analysis.

## QUALITATIVE-ICONIC

In this first city walk, the researchers encountered different examples of urban art in downtown Chapecó. The excerpt shown above, with 16 specimens, is a synthesis of 52 urban art findings. The first perception is that there is a range of different techniques, colors, forms and scales. The graffiti are the most colored pieces as well as the bigger examples of art in the city. The “lambe-lambes”, or posters are usually in black color with no illustrations and present an emphasis in textual composition. These posters or stickers have scratches of having been torn apart, presumably by the people of the city. In summary, we can say that qualitative expressions of these works are diverse in visual and graphical terms, as well as in technical aspects.

## SINGULAR-INDICATIVE

In general, the first excerpt of art works found in the city indicate that there is a broad range of themes, topics, subjects and meanings presented in the images/texts. The murals/graffitis suggest a more interpretive and symbolic meaning, for they are usually big images with illustrations

that attract the observer’s attention. So, these images are commonly viewed in the everyday life of the city, because of their scale. One aspect of consideration, is the use of anthropo zoomorphic signs in the images. Some examples merge animals with human bodies and indicate a more refined treatment of art, derived from a pictorial tradition. In contrast, the smaller pieces are presented in a scale that is not easily perceptible to the public. The themes of this work indicate a much more acute political aspect, for they are more direct in their messages, with social critics and activist profiles/questions. We can say that these works indicate a political appropriation of the city, which is coherent with the polarized political context of contemporary Brazil.

## CONVENTIONAL-SYMBOLIC

The symbolic meanings presented in the works derive from the diverse techniques and themes, as commented above. The illustrated pieces show distinct human and animal portraits, usually depicting meanings of freedom/captivity, with more oniric features. One work presented in the image above is graffiti done by famous local artist Digo, which presents a couple of colorful and bright wings, located in a popular street market in downtown Chapecó. It is common to see city citizens or tourists take a photo of themselves in front of this piece and post online. So, it is a symbol of liberation that is appreciated by the people of the town. In other expressions, we can find sharp symbolic political meanings. The posters found in this city walk show social commentaries that symbolize political positions and debates about sexism, feminism, social justice, LGBTQ+ rights, human rights and education. As an example, one poster found in a post lamp presents an illustration of a school chair with wings. The text right above the image reads “education is freedom”. Therefore, it is a

simple piece that symbolizes the social struggle for education in a country known for its poor education investments. In summary, the symbols presented in the city dialogue with the city's colonial history as well as the current social-economical context of Brazil, showing expressions that are critical of the government and the social injustices in the country. However, there are also illustrated pieces with more artistic profiles that have more open interpretations and are more socially acceptable.

responses to an urban lifestyle so what we have is a canvas waiting to be painted and paintings waiting to tell us something. Due the history context we presented in this paper we made it clear the singular aspects of Chapecó are a great source of urban expressions which have not been totally explored so far. We can see a great potential on a semiotic analysis in this context and the knowledge development in semiotic studies applied to the urban art world are very promising in Chapecó's scene.

## FINAL CONSIDERATIONS

We found the semiotic analysis in Chapecó's urban art can show us more than we expected about the city's imaginary sphere. The results we have so far are vague but we have to remember that this research is currently in a very initial stage and we have so much more to read, explore and analyse than we have presented in this paper. The plurality and diversification of urban expression in this city could clarify the questions and thinkings artists or anonymous subjects are facing nowadays. We are not just asking that old question "if the walls could talk, what would it say?", we are on the way to find an answer to this question. We believe the city walls can talk to all of us, through the paint and glue of urban expressions that surround us. A public library is not the only place where we can know something about the history of the city. The urban space can also show us the way we are treating our relation with the space we occupy. People make history everyday and the registration allied to a responsible study of urban art is deeply important to this purpose. The first city walk we took already showed a great amount of urban expressions which we could analyse, and our next move is to explore even more of what the city has to tell us. The city is a room full of spectators with its walls covered in art. This manifestations are directed

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# Eco-friendliness perception in packaging design: The importance of color, material and environmental claim



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## Abstract

Consumers' environmental concerns are increasing. There is scarce research on the role of packaging as an influencer of environmental perceptions. Also, consumers find it hard to effortlessly differentiate green from non-green products on the shelf. This research focuses on how environmental claim, materials and color of packaging could enhance consumers' perception of eco-friendliness. Hence, two experimental studies were conducted to analyze the presence of environmental claims (Study 1), packaging material (plastic vs. paper) and color saturation (light vs. dark green) (Study 2). A total of 429 participants showed: (1) the presence of environmental claims in packaging design increase eco-friendliness and purchase intention; (2) paper packaging is perceived as eco-friendlier than plastic packaging; and (3) color saturation in packaging design does not impact eco-friendliness nor purchase intention. Our findings could inspire marketers which are struggling to communicate their green products, and thus support brand managers to redefine their strategies.

## Keywords:

**Green products; Eco-friendly packaging; Consumer behavior; Environmental claim; Purchase intention; Color.**

## 1. INTRODUCTION

Consumption of goods and services has increased enormously over the last decades, which caused a decrease of natural resources and aggravated the environmental conditions worldwide (Chen & Chai, 2010). As a result, consumers have been trying to adopt sustainable habits by changing their purchases toward environmental products (Bockman et al., 2009; Schmeltz, 2012). Nonetheless, the adoption rate of green products has been falling (Clifford & Martin, 2011). Prior research has focused on profiling the typical green consumer (Schlegelmilch et al., 1996; Shrum et al., 1995) and understanding the willingness and motivation behind acquiring green products (Doorn & Verhoef, 2011; Griskevicius et al., 2010; Lin & Chang, 2012). However, the understanding of the package environmental cues and its consumers' perception is still limited (Rokka & Uusitalo, 2008). However, the role of the package in consumer's selection of eco-friendly products is critical to communicate an environmental message through its visual elements (Rundh, 2005). Current research on the effect of packaging's visual elements shaping consumers' perceptions about product eco-friendliness only focuses on the color and suggests that a green packaging enhances product's environmental perception (Seo & Scammon, 2017). However, a package also includes other visual elements – such as saturation of the color, type of material and existence of the environmental claim – which can shape product's environmental perception, and enhance purchase intention (Aagerup, 2019). Thus, we seek to explore visual elements that could increase consumers' eco-friendly perception of environmental products. Our study extends the existing research on green color as an enhancer of the environmental perception by combining two saturation levels of

the green color (light and dark) with the packaging material – such as plastic and paper, and the existence of an environmental claim. Accordingly, it narrows the observed gap in the literature in which the effect of the packaging's visual elements on consumer's perception of a product's sustainability impact is not sufficiently observed compared to other consumer's perceptions, such as nutrition labels or package volume (Dong & Qian, 2013; Huang & Lu, 2016; Krishna, 2007). The remainder of this manuscript includes a literature review, followed by the methodology and results sections for two experimental studies. Lastly, we present the final discussion with the managerial and theoretical implications, as well as the limitations and suggestions for future research.

## 2. LITERATURE REVIEW

The beginning of the twenty-first century was notable by consumers growing environmental consciousness and awareness of the consumption's negative impact in several environmental problems worldwide (Leonidou et al., 2010; Svensson & Wagner, 2012). Therefore, consumers are modifying their purchase and consumption behavior to reduce their environmental impact. As a result, the demand for green products has increased exponentially in the market. Nevertheless, it is a challenge for brands to provide a clear communication of green products, as consumers could not be able to quickly differentiate between green and non-green products (Lu et al., 2013).

### 2.1 ENVIRONMENTAL ISSUES AND THE GREEN TREND

Over the last decade, a significant increase of goods and services consumption caused severe

damage in the environment, such as global warming, an increase of pollution, and a decrease of natural sources worldwide (Chen & Chai, 2010). With pollution levels growing every year, environmental concern has rapidly become a central topic for companies that are increasingly using green opportunities (Haden et al., 2009; Molina-Azorín et al., 2009). Also, awareness of the environmental issues has increased consumers' willingness to save the environment from further deterioration throughout their purchase behavior by focusing more on sustainability (Chen & Chai, 2010).

Consumers became more interested in products that cause less pollution, use fewer natural resources, and are less harmful to the overall environment (Luchs et al., 2010; Mackoy et al., 1995). Research from Chen (2010), demonstrates that consumers are not only eager to purchase green products that are not harmful to the environment, but also to pay more for those products.

Environmentally friendly products are characterized as products that minimize the environmental impact of their consumption (Janssen & Jager, 2002). Ottman et al. (2006) add to the definition that green products are those protecting or enhancing the natural environment with the conservation of energy and resources, and by reducing or eliminating the use of toxic agents, pollution, and waste. Therefore, marketers are using this green trend to introduce more sustainable products in the market and build a competitive advantage (Magnier & Schoormans, 2015). However, the number of successful environmentally friendly products is not satisfactory (Gleim et al., 2013). Marketers are still not considering all the visual elements of a package to communicate their environmental messages.

Marketers noticed the importance of environmental labels as a marketing tool to attract green consumers (D'Souza et al., 2006).

Consumers are more likely to choose a product with an environmental claim than without one (Giannelloni, 1998; Polonsky et al., 1998). As consumers take into consideration the information displayed in the claims, the material needs to be in line with these claims (Jerzyk, 2016), otherwise the brand trust can be damaged (Darke et al., 2009). Therefore, we expect the presence of the claim to increase environmental perception, when considering a raw material paper packaging. Accordingly, the following hypothesis is proposed:

*H1. A product using a raw material paper packaging with an environmental claim will be perceived as environmentally more friendly than one without an environmental claim.*

## 2.2 PLASTIC VS. PAPER PACKAGING

Packaging plays an important role in marketing (Rundh, 2005). Basically, it generates consumer attention and creates differentiation on the shelf. Consumers often make the first judgments about brands and products based on their packages (Orth & Malkewitz, 2008). Additionally, the packaging is also a communication vehicle growing significantly, and thus traditional brand building mass media is decreasing (Belch & Belch, 2001).

Since the 1990's, the demand of environmentally friendly packaging has been increasing.

Consumers prefer the use of materials that can be recycled or reused such as paper (Faccio et al., 2015). The material of a package communicates different meanings to consumers, depending on their materials' perception. On the one hand, the paper is perceived as more impactful due to its process of production, but on the other hand, plastic creates many concerns on consumers due to its recyclability (Klaiman et al., 2016). Following the research from Seo and Scammon (2017), which concludes that a package using a green



background combined with an environmental claim is perceived by consumers as eco-friendlier than in other colors. We add one more variable to this setup: the material (plastic vs. paper), in order to understand how consumers perceive a product's environmental friendliness. Hence, it is likely that consumers will perceive a product with a package made of paper to be eco-friendlier than another made of plastic. Thus, the following hypothesis is proposed:

*H2. A product using a green packaging combined with an environmental claim will be perceived as environmentally more friendly when its package is made of paper rather than plastic.*

### 2.3 COLOR SATURATION IN ECO-FRIENDLY PACKAGING PERCEPTION

Color is an integral element of marketing communication (Schmitt & Pan, 1994), a marketing tool able to attract consumers and shape their perceptions. Labrecque (2012) suggests that a brand can establish an effective visual identity and position itself among competitors through color. One of the critical functions of color is to provide meaning, which makes daily lives easier and allows consumers to identify products quicker. A study suggests that 60% of the first impressions of products comes from color (Nenycz-Thiel & Romaniuk, 2014). Although color has been extensively studied, research is still lacking when considering green products in a marketing context. Color hue was studied in a recent research conducted by Seo and Scammon (2017), in which the authors demonstrate the positive effect of the color green of a packaging on consumers' environmental brand perception. Nonetheless, the other two dimensions of color – saturation and value – have not yet been considered in this context (Labrecque et al., 2013). Different color saturation (i.e., intensity) in the

background of a package produces different meanings on the healthiness of a product (Dong, 2013). For instance, if the background of a package is displayed in a light and high saturated color, consumers perceive the product to be unhealthy. On the other hand, a less saturated color gives the perception of healthiness to a product (Mead & Richerson, 2017). Following this finding and combining it with the conclusions from Seo and Scammon (2017), we propose to test the influence of the saturation of the color green in the context of environmental products. Thus, the following hypothesis is presented:

*H3. A product with a less saturated (darker) green packaging will be considered environmentally more friendly than a more saturated (lighter) green packaging, both combined with the presence of an environmental claim.*

## 3. METHOD

### 3.1 STUDY 1

This first study seeks to analyze the level of eco-friendliness perception with and without the presence of environmental claim. The paper packaging is widely used in eco-friendly products (Faccio et al., 2015), therefore we manipulated a sample of coffee package using a brown colored paper. We tested two similar packages to examine if the paper packaging would benefit from the presence of the claim, thus enhancing a favorable environmental perception.

**Procedure.** An experimental setup (between-subject design) was used to understand the impact of a claim (with claim vs. no claim) in the eco-friendliness package perception. The study was developed using the platform Qualtrics and distributed online through Facebook. Participants were randomly assigned to one of the conditions.

Using Photoshop, we have manipulated the packages applying the color brown – the natural color of the paper – to give a better perception of a raw material. Thus, in one package we have used the claim “Eco-Friendly Packaging” under the brand name, and in the other package we have removed it (Figure 1).



Fig. 1. Paper package with claim (left) and without claim (right)

A pre-test was conducted with four people with different gender, age, nationality and academic background before starting data collection. No unclear questions or mistakes were detected. We started the questionnaire with a brief introduction and a question regarding the frequency of coffee purchase. Next, a picture of the paper package of coffee in its natural color (brown) was displayed with (or without) the claim “Eco-Friendly Packaging”, and four questions followed it. The first two questions were about environmental friendliness perception (Seo & Scammon, 2017), then the participants likelihood to purchase the product (Dong, 2013) and, lastly, their overall feeling about the brand adopted from Spears and Singh (2004). Finally, participants answered demographic questions regarding age, gender, nationality, and level of education. All participants were informed in the beginning that the study was run in a voluntary basis, and that information provided would be kept confidential.

**Measures.** To analyze the influence of the claim in the paper packaging on consumers’ perception of eco-friendliness, participants rated how environmentally friendly they perceived the product to be, on a 7-point items scale (from 1 = very unfriendly; to 7 = very friendly) and how they perceived the product in terms of its environmental impact (from 1 = very negative; to 7 = very positive), as applied in a research conducted by Seo et al. (2017). To measure the purchase intention, we used a 5-point scale (from 1 = definitely will buy; to 5 = definitely will not buy) which was previously used by Mullet et al. (1985). These questionnaires included a question regarding the overall feeling about the brand, measured with a bipolar scale of five-items: unappealing/appealing, bad/good, unpleasant/pleasant, unfavorable/favorable and unlikable/likable (Spears & Singh, 2004).

**Sample.** A total of 115 participants answered the questionnaire (61 without claim; 54 with claim). 68.7% of the participants were females. The age ranged from 18 to 44 years old, and more than 50% of participants were 25-34 years old. Portuguese (67%) and German (18.3%) nationalities accounted for the majority of the participants.

**Results and Discussion.** The data were analyzed with SPSS 23. The dependent variables are Environmental Friendly (EF), and Purchase Intention (PI) and the independent variables are “with the claim” and “without the claim”. Using the Kolmogorov Smirnov test ( $n > 50$ ), the assumption of normality was not validated for the dependent variables, and thus it is assumed there is no Normal distribution for the entire population, as all groups have a p-value of less than .05 ( $\alpha$  of reference). However, the violation of the assumption of normality about parametric results has been studied continuously (Hair

et al., 2010). In order to find out if there are statistically significant differences between the two conditions, we used the non-parametric Mann-Whitney test. Significant differences were reported between the groups for the variable EF ( $p = .004$ ), but no significant differences were found for the variable PI ( $p = .886$ ). Furthermore, a simple linear regression was performed for the feeling towards the brand which was statistically significant,  $F(1, 52) = 19,978$ ;  $p < .001$ . Through the analysis of the standardized regression coefficients (EF), we concluded that participants had a positive and higher feeling of the brand towards the package with an environmental claim ( $\beta = .527$ ) than the package without an environmental claim ( $\beta = .332$ ). Finally, the statistical test revealed that the paper package with the claim ( $M = 67.21$ ) was perceived as being more environmentally friendly than the paper package without claim ( $M = 57.61$ ). Hence, H1 was confirmed.

### 3.2 STUDY 2

The second study was conducted around two weeks after the first one. The main objective consisted in identifying which elements of the package will make the perception of a product environmentally superior. Following the recent findings of Seo and Scammon (2017), green color was found to be a facilitator of the environmental claim and thus induces superior environmental perception of the product. We will extend this research through green color saturation and package material combined with an environmental claim, to understand the impact on consumers' environmental perception and purchase intention.

**Procedure.** Similarly to Study 1, we have followed a quantitative approach, more specifically an experimental design. We used a between-subject design for the material condition (paper vs.

plastic package). To test the influence of color, we used a within-subject design for each one of the two groups previously stipulated (dark green vs. light green). Accordingly, two questionnaires were created in the Qualtrics platform and disseminated online through Facebook. Four coffee packages were created using Photoshop to avoid biases in responses. In questionnaire A, we have used two packages of coffee made of plastic (Figure 2), one in dark green and another in light green, and in questionnaire B, we have displayed two packages of coffee made of paper (Figure 3), one in dark green and another in light green. All packages of coffee had the same brand name in the center, and a claim "Eco-Friendly Packaging" displayed at the bottom.



Fig. 2. Plastic coffee package in dark green (left side) and light green (right side)



Fig. 3. Paper coffee package in dark green (left side) and light green (right side)

Before starting the data collection, a pre-test was conducted with eight people (four for each questionnaire) with different gender, age, nationality, and academic background. The purpose was to identify unclear wording and format of questions and also estimate the completion time for the questionnaire. Some adjustments were made for the sake of consistency and better comprehension of the questions.

The first part of the questionnaire displayed a package of coffee with dark green background and the second part showed the same picture but with a light green background. The questionnaires started with a short introduction about the aim of the research explaining that the goal was to analyze people's purchase and consumption of coffee.

In the first section, participants started the questionnaire by answering a question regarding their frequency of coffee consumption. Secondly, a dark green package of coffee in plastic (or paper) was displayed, and participants answered three questions: (1) environmental friendly perception; (2) environmental impact of the products (Seo & Scammon, 2017); and (3) likelihood of purchasing the package (Dong, 2013). Thirdly, we exhibited a light green package of coffee in plastic (or paper) and repeated the same questions. In the following section, both products were displayed, and participants had to rate both the eco-friendliness and the purchase intention for the products displayed. Finally, participants indicated whether they were colorblind or not and answered demographic questions regarding age, gender, nationality, and level of education. All participants were informed in the beginning that the study was conducted on a voluntary basis, and that the information provided would be kept confidential.

*Measures.* Multi-item reflective measures were implemented by adopting scales previously validated in other studies on consumer behavior

concerning packaging and colors. To evaluate the influence of the saturation of the color green and the material of the package on consumers' perception of eco-friendly products, participants rated how environmentally friendly they perceived the product to be, on a 7-point items scale (from 1 = very unfriendly; to 7 = very friendly) and how they perceived the product in terms of its environmental impact (from 1 = very negative; to 7 = very positive), as applied in a recent research (Seo & Scammon, 2017).

*Sample.* In total, 341 participants answered the questionnaires. However, 27 of them were excluded due to color blindness. Thus, our final sample consisted of 314 participants – 141 for questionnaire A (paper packaging) and 173 for questionnaire B (plastic packaging). 59.4% of the participants were females. The age ranged from 18 to 44 years old, and more than 50% of participants were 25-34 years old. Portuguese (59.4%) and German (19.4%) nationalities accounted for the majority of the participants.

*Results and Discussion.* The collected data were analyzed with SPSS 23. The assumption of normality was not validated for the dependent variables, using the Kolmogorov Smirnov test ( $n > 50$ ) for all groups. However, as the homogeneity of variances was validated, the parametric test chosen was the ANOVA two-way, which allows comparing more than two populations defined by two independent factors. The dependent variables were purchase intention (PI) and environmentally friendly (EF), the independent variables are the saturation of the green color (light green and dark green) and the packaging material (paper and plastic). The data was analyzed with a 2 (paper package vs. plastic package)  $\times$  2 (dark green vs. light green) ANOVA. In terms of package material, there was a significant two-way interaction between material and environmentally friendly perception – EF ( $F(1,1) = 34.360$ ;  $p < .001$ ) and

PI ( $F(1,1) = 6.050$ ;  $p = .010$ ). The statistical test revealed that the package made of paper was perceived as being more environmentally friendly ( $M = 5.120$ ;  $SD = 1.239$ ) than the package made of plastic ( $M = 4.170$ ;  $SD = 1.570$ ). Therefore, consumers were more willing to purchase the package made of paper ( $M = 3.080$ ;  $SD = .944$ ) than the package made of plastic ( $M = 2.820$ ;  $SD = .938$ ). Thus, H2 was confirmed. Regarding the perception of the dark green and light green package, the statistical test revealed that the package colored with dark green ( $M = 4.710$ ;  $SD = 1.415$ ) was not significantly different, for both EF and PI, in comparison with the package colored with light green ( $M = 4.490$ ;  $SD = 1.587$ ). There was not a significant difference for dark and light green paper compared to dark and light green plastic package, for both variables – EF ( $F(1,1) = 1.270$ ;  $p = .250$ ) and PI ( $F(1,1) = .540$ ;  $p = .450$ ). Therefore, H3 was not supported.

## 4. GENERAL DISCUSSION

The purpose of this research was to examine the relationship between packaging visual elements and consumers' perception of environmentally friendly products. We sought to enrich the literature on green products demonstrating how packaging elements (i.e., environmental claim, material and color saturation) could enhance the perception of environmental friendliness on products, as well as their purchase intention. Occasionally, it could be difficult for consumers to distinguish between ecofriendly and non-ecofriendly products. Our findings showed that a paper package, rather than a plastic package, will facilitate consumers to form their environmental perceptions. In addition, the paper packaging enhances consumers' environmental perception of the product when combined with an environmental claim. Furthermore, the more environmentally friendly is the product perceived,

the higher is the purchase intention.

### 4.1 THEORETICAL CONTRIBUTIONS

This study builds on recent research about green color and its impact to enhance the degree of fluency to read the packaging environmental information of a product (Seo & Scammon, 2017). First, we demonstrated that other packaging elements such as the material also has an impact on the ease of processing the information (perceptual fluency theory). A paper packaging will facilitate the consumer to read environmental information of a package due to paper's association with nature. In addition, we also showed that the effect of the paper packaging is more relevant when combined with an environmental claim. Unfortunately, we found no evidence for a difference between high and low saturation of the color green in consumers' environmental perception of a product.

### 4.2 MANAGERIAL IMPLICATIONS

Marketers are increasingly seeking to follow the green trend and focusing on either making one of their current brands eco-friendlier or developing a new brand to cover this opportunity in the market. However, they are most likely not communicating their green products in a proper way. Consequently, consumers could not effortlessly distinguish a green (eco-friendly) product from a non-green product. Moreover, marketers invest a significant part of their budget in packaging and label, as these attributes have shown to attract consumers' attention on the shelf. Specifically, different packages communicate distinctively to consumers through visual elements, such as material, shape, size, color, and imagery.

Our findings could inspire green brands which are struggling to communicate with their target, and thus support brand managers to reposition the



brand. Managers must take into consideration that a package made of paper, rather than plastic, will have a higher positive impact on consumers' environmental perceptions and, consequently, in their purchase intention. Moreover, it is essential to combine it with an environmental claim, otherwise the product may not be perceived as eco-friendly. However, the perception of packaging materials may differ among the category of products and consumers' level of knowledge about green products. In conclusion, a brand needs to consider color, material, and claim to communicate their identity and create a positive feeling to the consumer.

#### 4.3 LIMITATIONS AND FUTURE RESEARCH

The present research has some limitations that must be considered in future research. First, we used scenario studies. The development of real situations may be of great added value for the literature (Tsai & Lee, 2007). Hence, future research should create real in-store scenarios with a limited time to look at the product according to the real time spent in front of the shelf to have more accurate results.

Another limitation of this study is the package design, which incorporates several elements (e.g., format/shape, images) that could impact consumers' perceptions, and thus may have created biases and misperceptions. Also, several claims could be applied to an eco-friendly product with different levels of impact on consumers' perception. Hence, future research should not only explore elements of the package, such as logo, shape, imaginary and size but also repeat the use of color and material with other combinations of environmental claims to extend the results of this research.

Regarding the saturation of the green color, two limitations should be taken into account for future research. Firstly, the gap between the light and dark green color may not have been strong

enough. Secondly, the participants should have been assigned to different color conditions so that the results would have less contamination by extraneous factors.

Lastly, our study was limited to one product category (coffee), and thus future research should address another category of products – for example, FMCG products in which consumers require a higher performance (e.g., laundry products) or lower performance (e.g., serviettes). In conclusion, more studies are needed regarding the perception of eco-friendliness product packaging.

## 5. CONCLUSION

The packaging design shapes consumers' perception about the product and, consequently, influences their purchase decision. Our study examined how key packaging elements, such as color, material, and claim, influence consumers' eco-friendly perception of a green product and their purchase intention. Hence, this research brings a significant contribution to the marketing literature on packaging's design elements and green products. Overall, our conclusions may be taken into consideration by brand managers to help them designing their green product packages and ensure clear communication.

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# Information Design and Financial Literacy: a contribution to enhancing decision-making



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## Abstract

This document presents research that brings together information design and financial literacy. It considers both the point of view of information design and the role and importance of the design process in the comprehensibility of information. The dissemination and contracting of financial products – considering the discussion on intelligibility – defined this research on the profile of young adults and their relationships and expectations with money. A descriptive approach comprised four phases: a) literature review on financial education/ literacy, information design and research in this area; b) qualitative and quantitative research with young people on their financial literacy; c) experimental research using eye-tracking for analysis of comprehensibility of financial information. The results indicate that the main comprehensibility problem is not finding information while navigating on-screen, or how long it takes to find the information. The issue is that offered information is not comprehensive; moreover, it is not helping in this financial education process.

## Keywords:

information comprehensibility, financial education, financial literacy, empowerment, ergodesign

## 1. INTRODUCTION

Talking about financial literacy is talking about information design. Leaflets, websites, among other promotional pieces, are the source for financial education, as well as decision making. Previous research finds that interactions with peers, family, culture, and media, shape the financial knowledge of young people, particularly their attitudes as consumers (Ali et al., 2014). Such a context leads us to an understanding of financial literacy. It is not a general or easy concept, as several terms are used, such as financial education, financial knowledge, financial literacy, and health literacy. Huston (2010) suggests that financial literacy could be defined as measuring how well an individual can understand and use personal finance-related information. This author associates financial literacy, knowledge, education, behavior, and well-being. According to Lusardi (2015), young people should make significant decisions early in life, for example, whether to go to college and how to finance that education. These financial decisions, from this author's point of view, increase in individual responsibility, and has implications not just for individuals but also for society. Lusardi (2015) also questions if individuals are well-equipped to make these types of decisions.

To Lusardi et al. (2017), financial education programs have become an essential topic of research given the need to improve financial literacy among individuals. Authors also affirm that 'work has also focused on financial education for young adults' mentioning some other papers, as:

- the work of Walstad et al (2010),
- the two articles of Carlin and Robinson (2012 a, 2012b) about the achievement of the research with this profile of consumer,

- the experiment of Bechetti et al. (2013),
- the debt behavior discussed by Brown et al. (2013),
- moreover, aspects of teaching in Lührmann et al. (2015).

From the information design point of view is fundamental to understand the role and importance of the design process in this scenario. This context leads us to two questions: how the information presented can be related to comprehension? Do young adults understand the information available about financial products? This paper aims to present an investigation considering the profile of young adults and their relations and expectancies with money, and comprehensibility of the information about the dissemination and contract of financial products.

## 2. METHOD AND RESULTS

Descriptive research in four phases was established as a method to achieve this research objective: a) literature review on financial education/ literacy, information design and research in this area; b) qualitative and quantitative research with young people on their financial literacy; c) experimental research using eye-tracking for analysis of comprehensibility of financial information. Each phase will be presented in the following topics, with its results.

### 2.1 LITERATURE REVIEW: DESCRIPTION AND RESULTS

According to the literature review results, that were valuable to introduce and give the context of this article, only a few types of research about this topic could be found in the design field. Even though most references are available in Law, Economics, Mathematics, Social Behavior,

Education journals - as expected - information, its quality, and ways of presentation is a topic of concern for all of them.

Some authors reviewed for this paper, like Bandura (1989), presents the social cognitive theory and self-efficacy expectations influence behavior change. Perceived self-efficacy is the belief in one's own ability to perform successfully in a situation.

Lusardi (2012) points out that individuals often struggle with processing information that requires extensive calculations – this type of processing requires a high level of numeracy, which many individuals do not possess.

Huston (2010) affirms that literature on the cause and effect relationship between financial education and financial literacy is highly limited. To be financially literate, individuals must demonstrate the knowledge and skills needed to make choices within a financial marketplace that all consumers face regardless of their characteristics.

The information design presented to consumers of financial products has a direct relation with decision making. Since 2005, OECD (2019) established that it is essential that financial institutions check if clients/ consumers are comprehending all information offered. From this perspective, financial literacy and financial education and information is a topic that matters worldwide.

Considering that this research is being carried out in Brazil, an essential aspect of financial education was the results of the Inaf report (2018). This report shows impressive numbers of literacy and reading skills of the Brazilian population:

- **8%** is considered **illiterate**, since they are unable to read and write,
- **12%** is at a **rudimentary level**, it means, can find one or more explicit information, expressed literally, in straightforward texts such as calendars,

simple tables, and informative posters,

- **34%** can be considered at the **elementary level**, since they can select one or more units of information, observing certain conditions, in diverse texts of medium length, performing small inferences,
- **25%** are in **intermediate level**, since they are capable of finding expressed information in either journalistic or scientific texts, performing small inferences, in a literal way,
- Finally, **12%** can be considered at the **proficiency level**. Citizens in this profile understand documents of greater complexity based on elements of a given context and can provide an opinion on the positioning or style of the author.

Therefore, if people can barely understand the daily information, is the majority of this population prepared to deal with information on financial products?

The achievements of the literature review were the basis for the next phase of this research, which considered a qualitative approach. All these aspects – financial education, financial literacy, self-efficacy, numeracy, financial decision making, quality of information – should be considered during the studies of this topic, and the design process of information.

## 2.2 INTERVIEWS: DESCRIPTION AND RESULTS

The second step was to define that a qualitative approach was needed to understand its relationship to the subject of financial education and the perception of the information available on the financial market about its products for young adults. Semi-structured interviews were carried out with young adults from 15 to 29 years old.

The topics considered for the interview were the following:

- which is the source of information for these young adults,
- how have they “learned” to deal with finances,
- if do they had any formal financial education whenever there were “problems with money”, which were the main ones, and
- how concerned about money they are today, and also about the future.

A total of 12 volunteers (7 males and 5 females) participated ( $M = 23,83$  years;  $SD = 2,62$ ). The majority ( $n=8$ ) affirmed that they were not ‘taught’ about finances and mentioned that they do not remember having any formal financial education. Other volunteers ( $n=4$ ) cited that remember about math problems at school that related to money, like percentage calculation. When asked about how they deal with money, problems dealing with money and perspectives for the future, answers were divided into two groups: not employed and employed. Not employed volunteers ( $n=7$ ) say they receive a monthly amount from their family for personal expenses, and they spend whatever they receive. So, they do not have problems at all. If the money runs out, some of them ( $n=3$ ) may ask for the amount for the following month. Therefore, the strategy is to think about the priorities, to avoid a new month without money. For now, most of this group ( $n=6$ ) is not concerned about the future. They believe they will be more interested when they have their own money and will need to deal with different expenses. Answers indicated that they talk about finances with family, friends, or via Internet research. Employed volunteers have a different relationship with money, since they cannot ask for more.

Paying the bills comes first. In case of some extra money, they usually spend it on entertainment. Also, if there are no entertainment expenses, they save for the next month. However, it is not exactly the concern with the future, but the “near future”.

The results point out that both employed and not employed use debit cards linked to their bank accounts. They consider it safer than having cash, since no one can use the card once they have lost it.

The results of the interviews were valuable, but it was limited to the sample. So, it was decided that a broader range of opinions should be obtained, and a questionnaire was carried out.

### 2.3 QUESTIONNAIRE: DESCRIPTION AND RESULTS

After considering the answers to the interviews, a field survey was carried out as a quantitative approach through an online questionnaire. It included:

(a) three questions proposed by Lusardi & Mitchell (2007):

i. *“If the chance of getting a disease is 10%, how many people out of 1,000 would be expected to get the disease?”*

ii. *“If five people all have the winning number in the lottery and the prize is 2 million dollars, how much will each of them get?”*

iii. *“Let’s say you have 200 dollars in a savings account. The account earns 10% interest per year. How much would you have in the account at the end of two years?”*

(b) two questions proposed by Lusardi & Mitchell (2011):

iv. *“If the chance of being contaminated by a certain disease is 10 percent, how many people, in*



*a total of 1,000, can be contaminated?"*

*v. "If five people have the chance to win the lottery with the same number, and the total prize is 2 million Brazilian reais, how much each one will win?"*

(c) aspects of financial literacy based on references and others to set a profile; such as having their own money, their financial decision-making, and how financial matters "fit into" their thoughts and decisions about the future – also considered by Ali et al. (2014).

These questions were presented in the form of multiple choice and 28 questions as a Likert scale. The formulary also included answers for gender, age, and one word that defines the respondent as a consumer.

A pre-test with eight volunteers was applied. As an online questionnaire, the volunteers accessed it online and, when completed, they discussed with the research team their impressions of the standard form. These were young adults – from 21 to 29 years old – such as the interview volunteers, concerning the "Term of Agreement" aspects. The lower age range for volunteer in this research was 21 years old. It was determined once is the minimum age to consent in a research.<sup>1</sup> It was also considered the range 21-29 years old, once is the same used by the indicators of OECD report about Brazilian education (2019).

After verification of the pre-test results, the link for the final questionnaires was distributed through personal contact at several locations, including schools, malls, bus stations, universities, and other public places recruited from Rio de Janeiro city, Brazil.

A total of 132 participants answered the questionnaire, but only 114 forms were complete

and valid. Participants were mostly workers and students. Once accessing the formulary and agreeing with the consent form, participants were invited to answer the questions using a calculator, if necessary.

When calculating the results for the first question (i), 51.8% were wrong answers, and 48,2% were correct (n=114). Results for query 2 (ii) had the right answer from the majority, 77,2%. In the same way, question 3, which evaluated financial literacy, was right for the majority, 78.1%. Questions (iv) and (v) were about rudimentary calculations and had 100% of the right answers. It is not possible to say whether this result is a consequence of using calculators.

Considering the sample that answered the questionnaire, the majority, 79,1% (n=91) of the respondents have their own money, even when living alone 14% (n=16), with friends 3.5% (n=4), or still with the family, 82.5% (n=94).

Since the form also presented some statements as a Likert scale, it was possible to check some other opinions related to the research questions, considering the sample. Still, results are not included and discussed in this paper.

The results from this phase – both qualitative and quantitative research – indicate that most young adults, whether having jobs or in college/university, still live with their parents, and have concerns about their financial future. Yet, they are still not involved with such matters.

Most of the respondents also affirmed that family and parents are the primary source of information about finances.

This result is consistent with the idea that "the role of parental financial modeling is found to play a pivotal role in how young people manage income and negotiate debt" and "discussing financial matters with parents is positively

<sup>1</sup> In Brazil, 'Consent terms' must be signed by volunteers older than 21 years old. For youngsters, For the youngest, the approval of a tutor is required, and it is called 'Term of Assent'. (Term of Agreement)

associated with greater financial literacy in adulthood” proposed by Ali et al. (2014). Looking briefly at the results, we must say that these are not aligned with some authors, like Sinha et al. (2018), that affirms that “any young people are entering adulthood without adequate financial capabilities to ensure their future well-being and that of their children.”

## 2.4 EXPERIMENTAL RESEARCH: DESCRIPTION AND RESULTS

Experimental research using eye-tracking has been defined for the analysis of the intelligibility of financial information. As the basis for this choice, references were used to determine the investigation as Graham et al. (2012), Goldberg & Helfman (2011), Wedel & Pieters (2006) and Huang (2007)

Briefly presenting the eye-tracking methodology, it is used for understanding how individuals read and process data on information graphics.

While completion time and accuracy on specific tasks may indicate that differences or problems exist, a deeper understanding of eye-tracking strategies on information graphics may help to determine specific guidelines for designing graphs and selecting graph types for particular datasets and tasks” (Goldberg & Helfman, 2011).

Many types of equipment are available in the market. Still, summarizing what they do, it is possible to affirm that in eye-tracking, high-speed cameras precisely record a participant’s gaze to assess visual attention. These cameras are assembled either on a flat, stable surface – i.e. a desk – or worn by the participant (e.g., using cameras installed on a pair of glasses), as Graham et al. (2012),

In this research, the choice of eye-tracking methodology was designed to obtain precise results, avoiding personal impressions, memory shortages or poorly objective aspects of the interface, which are common when using these

techniques.

As mentioned by Graham et al. (2012), one of the advantages of this type of equipment is that usually volunteers “may provide inflated responses to align with what they perceive to be more acceptable or popular behaviors.” These authors affirm that using eye-tracking, participants may be less susceptible to social desirability. Authors also highlight that “the demand characteristics present in an eye-tracking study may be less salient, and the behavior being monitored may be more instinctive” Graham et al. (2012).

On the other hand, for these authors, it is necessary to consider the limitations, since research utilizing eye-tracking methodology may lack realism for the participants in the study. This experiment was conducted to 1) see which areas were most prominent during eye movements; 2) check if the participant could answer the scenario question based on the information available on the website. The first is a graph reading behavior, and the second, a comprehensibility measure.

Four websites of relevant banks were selected for analysis, with the aim of setting up a scenario for this research.

A pre-test was carried out with 12 young adults as volunteers recruited on an entirely voluntary basis. They all had normal vision and were regular computer users. No compensation or reward was given to participants for the completion of their tasks or answers.

The testing room was controlled by one person from the research team, who set the Tobii X2-60 eye tracker to a laptop computer. The eye-tracking system was running on this laptop, in which the scenario was presented to volunteer, and he/she could access the internet through it.

Before the pre-test session, all participants were informed about the research and a general overview of the test. The importance of maintaining posture during calibration as

well as during testing was explained. They were instructed to be seated in the same way during the calibration and test and should be comfortable from the beginning of the session. Since the room had adjustable chairs and tables, it was easy to make all adjustments before starting the test. These are crucial points, as changes in eyes height or movements can affect the data readings. Using the Tobii Studio software, it was set up to capture gazes and fixations of the participant's eye movement. According to Wedel & Pieters (2006), eye movements are strongly associated with visual attention, which makes them valuable indicators of the covert visual attention process. The experiment was conducted on an individual basis. After some practice, subjects performed the tasks online. None of the participants had ever browsed this bank's website. The scenario was the following:

*"You have a part-time job. It is not a big amount of money, so you decide to invest in a savings account. Checking the bank's website, you try to find out: a) how does this investment work? b) how much does it give you in return? c) what is the amount to be paid to the government?"*

Underlined words were stressed to indicate the type of account to be searched, and a savings account is considered an investment by the banks. A post-task questionnaire was given as short semi-structured interview held with the subjects covering some demographic data:

- . name; age; gender and occupation,
- . if the respondent has a bank account,
- . if yes, if it is digital or conventional,
- . if the respondent has some type of bank

financial investment, and how he/she obtains financial information.

The task could be carried out in 4 steps from the homepage, considering two paths:

> Homepage/ page 1 – the participant should select from the left navigation sidebar, "Products and services",

> Page 2 – When on page "Products and services," the participant should select the "Investments" option,

> Page 3 - When on page "Investments", the participant should click on "savings account" option,

> Page 4 – Once on the "savings account" page, the participant should click on "Revenue" to read all information about this investment.

Figure 1 presents the possible paths to reach the answer to the proposed scenario during the experimental research.

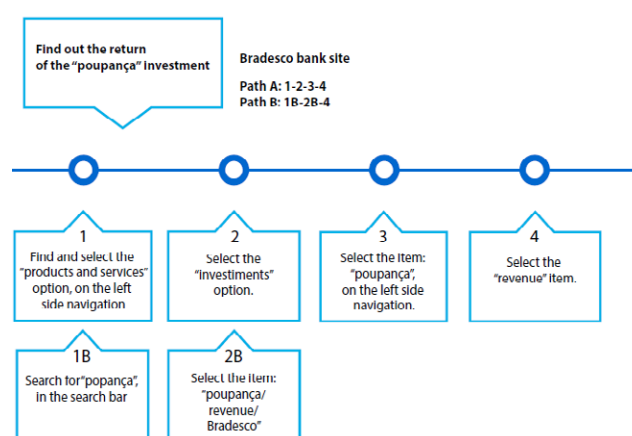


Fig. 1. - Paths to complete the scenario task. Source: authors, 2019.

From the home page (Fig. 2), the volunteer was expected to be able to select the Products and Services option on the left side of the navigation. This option leads him/her to the Products and Services page (Fig. 3) where the Investments was the option to be selected. Once on the Investments page (Fig. 4), the volunteer could select the option Savings ('Poupança'). Clicking on this option, a complete page about this topic is

presented (Fig. 5), where the volunteer could read in Revenue, all details to conclude the scenario task.

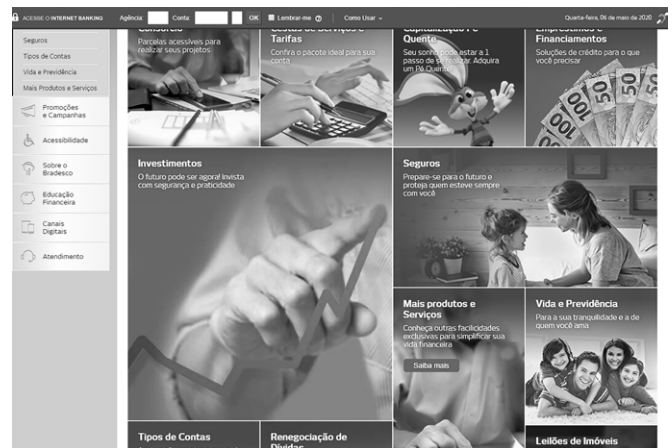
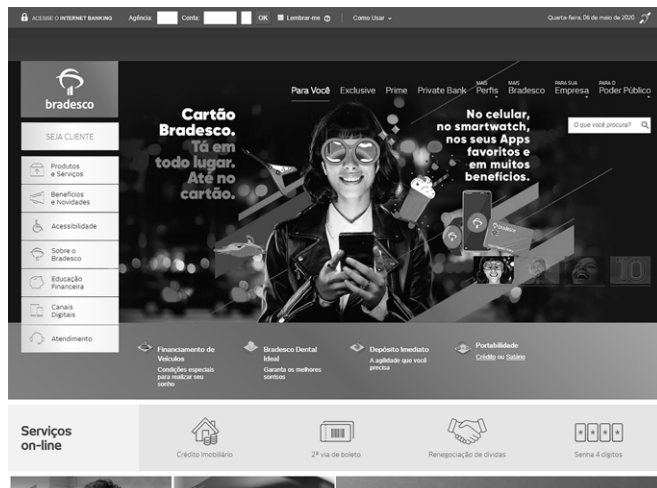


Fig. 2. and 3 - Website home page, the first of the expected navigation (left), Products and Services page, the second of the expected navigation (right). Source: authors, 2019.

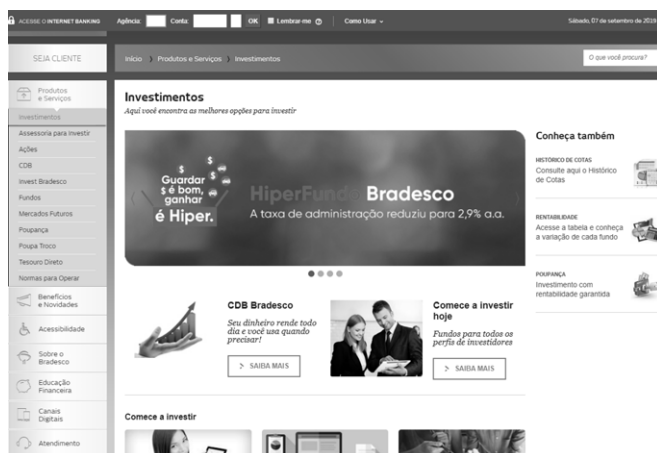


Fig. 4 and 5. -Investments page, the third of the expected navigation (left), and Savings ('Poupança') page, the fourth and last of the expected navigation (right) Source: authors, 2019.

Tobii Studio software allowed the research team to record in video gaze plots and heat maps of all participants' performance, as seen in figures 6 and 7.



Fig. 6 and 7 – Example of Gaze plots (left) and heat map (right) registered during the experiment. Source: authors, 2019.

The analysis of the data focused on two data: how long it took the volunteers to complete the task and on which elements of the screen, the eyes were fixated.

The total average time to perform the task was 121,8 seconds, with a standard de-viation of 39,36 seconds. Even with this variation of time, all volunteers were capable to complete the task. Most volunteers (n=9) were able to complete the task by navigating four pages. The other three

completed navigation in five pages. All of them started searching for information in a peripheral way, and then focused on the center of the page. Once comparing the results for gaze plots on the first four pages, there were no significant differences in fixation time, as shown in table 1.



Page	Mean (seconds)	Stand deviation
1	79,3	28,9
2	74,4	40,1
3	45,5	25,8
4	55,0	32,7

Table 1. – Average and standard deviation considering each page of navigation

However, reaching the Revenue page (browsing four or five pages) is not exactly the same as answering the scenario's questions: a) how does this investment work? b) how much it gives you in return? c) what is the amount to be paid to the government?". The information was provided on this page, and for three volunteers it was complicated to understand its meaning, they were supposed to have more experience with financial expressions such as Monthly income:  $TR + 0.5\%$  per month or Selic.

The research team believes that the small sample may have influenced the results, and a larger sample should be considered in the continuance of the eye-tracking test.

Takeaways and next steps

As any methodology interviews, questionnaires, and eye-tracking techniques have limitations, which should be presented here.

For the two first techniques, the interviews and questionnaires are limited by the sample that participates, their knowledge about the topic, and the way that participants consider each question when answering.

Once comparing both qualitative (interviews) and quantitative (questionnaires) results, it is possible to answer the research questions:

.Are young adults 'literate' from the 'financial point of view'? In this sample, it is possible to say that the majority is literate, considering the results of the right answers based on Lusardi & Mitchel (2007, 2011) questions.

.How do they behave, feel, and think about money and the future? In this sample, finances

are a concern and how they will deal with money in the future.

The results of the experimental research, using eye-tracking to analyse the comprehensibility of financial information, pointed out that the main comprehensibility problem is not finding information while navigating on-screen, or how long it takes to find the information. The issue is that the information offered is not comprehensive; moreover, it is not helping in the financial education process.

When analyzing eye-tracking results, defining fixations or metrics; an error in gaze location and scan path interruptions must also be mentioned (Goldberg & Helfman, 2011). These authors also highlight that 'studies with sequential visual strategies for completion of tasks can benefit from eye-tracking methods,' but it is necessary to defining appropriate eye-tracking metrics. Otherwise, it can be challenging to compare results and conclusions across eye-tracking studies due to differences in defining methods and metrics.

At this point in the research, each result of each technique is being taken into consideration for the analysis of the eye-tracking pre-test and the implications for the definitive test. Another point considered for the eye-tracking test is the intention to continue checking for different bank's websites, avoiding those that are familiar to volunteers.

So, the next step of this research is to have a broader sample for the experiment to check if the conclusions of pre-tests can be confirmed.

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# Fashion, Advertising and the social and cultural context

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## Abstract

The main subject of our research project relates to how advertising and communication reflect the social and cultural changes that have shaped different moments in fashion.

Literary research has allowed us to draw two timelines of the main subjects of our investigation - fashion and advertising - comprised between the second half of the twentieth century and 2019.

Such timelines have allowed us to single out three key moments of change in fashion, and the designers most linked with them, as our three case studies.

Through the study of the cultural and social context of each case study, we were able to pick the main ideas associated with them.

After gathering and analysing five communication examples for the three brands of the designers associated with each case, we were able to identify the key messages being conveyed by each one.

Through the comparison between the ideas associated with each Case Study and the messages featured in the communication of the three brands we tried to understand how advertising and communication adapt to the social and cultural changes that shape fashion.

## Keywords:

**Fashion, Advertising, Social Context**

## 1. INTRODUCTION

It is fairly easy to accept that fashion can act as a mirror of society, as clothing is so often used as a means of self-expression, strongly influenced by one's ideals and beliefs. As so, fashion designers tend to use their creations as a canvas into which they add messages and meanings that can be viewed as a natural reflexion of the social and cultural context of each era.

However, how advertising, an area connected to both fashion and social behaviour, reacts to the key moments of social and cultural change that shaped fashion evolution is a topic that is open to research.

With that in mind, our study focuses on the two previously mentioned areas - fashion and advertising - as we aim to comprehend their relationship, and try to gather if advertising and brand communication reflects the social and cultural changes that led to innovation within fashion.

With our aim set we were then able to define our main research question - How does advertising react to key moments of social and cultural change that shape fashion? -, which in turn led to two secondary questions:

- What are the main ideas behind these key moments of change within fashion?
- What are the messages beings communicated by the brands mostly associated with these moments?

With our aim defined and our questions established, we have developed a literary research that has allowed us to establish two different timelines, one for each area - fashion and advertising- , providing us a sense of knowledge regarding the social and cultural developments that took place from the end of the Second

World War until 2019. This allowed us to trace the changes of mentality that shaped society and entailed key moments of innovation in fashion. The information gathered from these two timelines proved crucial in the selection of the three case studies that constitute the main research methodology adopted: Mary Quant & the arising of the mini skirt; Vivienne Westwood's influence & the punk movement; the importance of John Galliano & the gender fluidity trends. From there on we structured our case study analysis based on three different phases for each case study: the first one being a contextualisation predominantly based in the social and cultural context of each of the case studies to identify five main ideas that propelled said moment of innovation; followed by a second phase, in which we analysed five pieces of communication from the brand associated with each case allowing us to pin point five key messages being conveyed by the brand; and finally a third phase where we crosscheck the five ideas that we gathered in the first phase with the five messages of the second phase, to comprehend if there are similarities that could demonstrate a relationship between advertising and the key moments of change within fashion.

## 2. FASHION AND ADVERTISING THROUGH THE 20TH CENTURY

Concerning the evolution of fashion through the 20th and beginning of the 21st century we noted that whilst in the forties fashion was severely restricted by the war, with rationing of fabrics and minor use of non-functional details, in the 50's Dior's New Look brought back a sense of femininity and detail to fashion (Heimann & Nieder, 2009), which was then followed by the

rise of the teenager in the sixties and quest for youthfulness in fashion with the miniskirt as a key piece and Mary Quant as the lead designer of the decade (Watt, 2012).

According to Heimann and Nieder (2009), in the seventies, and later in the eighties, the hippie movement, previously a counter culture, became the culture of masses, giving way to a more sustainable and political approach to fashion. Simultaneously, the disco and punk movement emerged: the first, based on the homonymous musical genre, became quickly associated with personalities such as Cher and Mick and Bianca Jagger, the flared trousers and extravagant costumes they used, and the nightclub Studio 54 in New York (Heimann & Nieder, 2009); the second emerged as a response to the positive atmosphere of the time and the decadence of rock, challenging the norm and establishing itself as the main counter culture of this period with Vivienne Westwood as one of the main influences

of style within the movement (Watt, 2012).

The author describes the mid and later eighties as a time of “more is more” with the power suit becoming one of the primary trends as women entered the male dominated markets and athleisure becoming everyday wear .

By the end of the century streetwear became a dominant force within fashion, with power shifting from the designers to the street, while hip hop and pop music videos became a major influence in fashion (Stevenson, 2010).

The 2000’s brought a more sustainable and inclusive notion to fashion (English, 2013), with vintage clothing becoming a major trend in everyday wear and inclusiveness appearing as a dominant topic within the industry strong enough to shake the reputation of designers such as Domenico Dolce and Stefano Gabbana, after racial insensitive comments, and raise awareness for brands such as Maison Margiela for their gender inclusive collections .



Fig. 1. Timeline of key moments during fashion evolution in the 20th century

As the second step on our literary research we focused on advertising and its evolution as we achieved to pinpoint some of the major trends and innovations that stood out within the industry itself during the timeframe of our research. Similarly to what happened at the beginning of the 20th century, in the 40's advertising was mainly used as war propaganda with icons such as Rosie the Riveter being used as a way of coaxing society into the idea of war itself (Tungate, 2007). According to Pincas and Loiseau (2008), advertising in the 50's was marked as most areas, by the boom that came after the end of the Second World War. Technological progress was in place and television surpassed radio as the number one means of communication in the United States of America. Photography becomes the norm as it replaces illustration in advertising with characters such as the Marlboro Cowboy highlighting that. The 60's became known as the golden era of advertising, as contrary to what happened previously, advertising becomes an appealing career path and Admen become celebrities.

The growth in advertising and the rise of a more consumerist society contributed to the excess of brands that led to an increasingly more individualist consumer (Tungate, 2011). Therefore the late 80's and 90's were a period of competition and innovation within advertising as brands tried to reach a consumer not only with options but also fuelled by the knowledge that globalisation gave him (Pincas & Loiseau, 2008). Similarly to what happened in fashion, advertising at the end of the 20th century and beginning of the 21st century saw the emerging of social awareness trends as brands such as Benetton come out with adverts that fail to show their products and focus instead on taboo topics such as racial discriminations or the HIV positive virus (Salvemini, 2002). In the 21st century with a consumer increasingly more sensitive to such topics, advertising tries as always to adjust to the needs and trends of the consumer with more female empowered, diverse and inclusive advertising, giving way to adverts such as

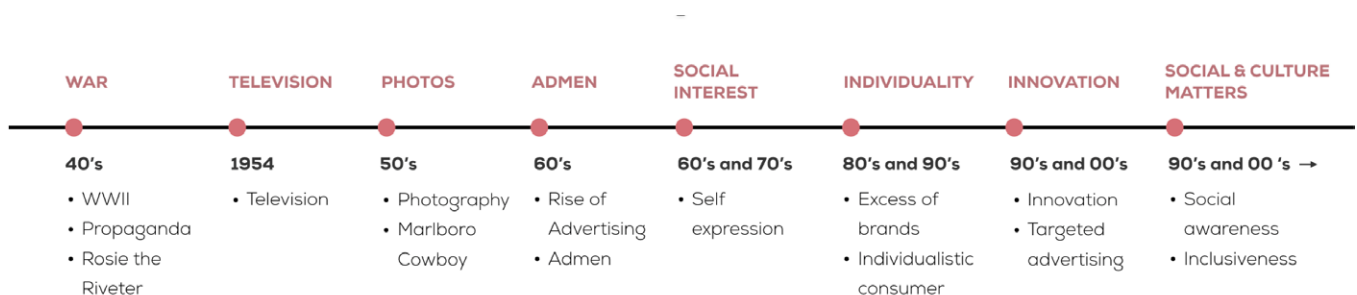


Fig. 2. Timeline of key moments during advertising evolution in the 20th century

Dove's Campaign for Real Beauty, where the brands attempt to make women see their beauty through someone else's eyes (Halon, 2015).

### 3. METHODOLOGY

#### 3.1. ADOPTED METHODOLOGY

The literary research previously develop allowed us to identify some of the key moments of social and cultural change that propelled innovation both in fashion and advertising. As so, we were able to pinpoint three main innovation within fashion and the designers mostly associated to them as our three case studies: Mary Quant & the arising of the mini skirt; Vivienne Westwood's influence & the punk movement; the importance of John Galliano & the gender fluidity trends. The selection of our case studies was based, first and for most, by the way in which they represent a specific moment of social rupture and innovation but also by the impact that they had not only in fashion, but also in society in general, both short and long term. According to Ellie Pithers (2009), Fashion Features Editor of British Vogue, the same non-conformist spirit associated with the miniskirt of the 60's can be associated in the same way to the non-conformist spirit of the #MeToo movement of the late 2010's. In the same way, according to Price (2004), punk has been an inspiration to multiple designers and collections since in it first appeared in the late 70's, and Vivienne Westwood can be considered, not only for her influence in the punk movement but also for the work that she has done since then "one of the most influential British designers of the 20th century". The third case study, being the most recent one, can be directly linked to the interest that the Gen Z demonstrates according to McKinsey & Company (2018) in topics such as human rights, ethnic equality, LGBTQ rights, and fluidity of gender. Clark (2019) defends that

even though gender fluidity is an hot topic, whilst other designers only started introducing the topic into their collections, John Galliano as creative designer of Maison Margiela "dived head first" into the trend.

#### 3.2. COMMUNICATION ANALYSIS STRUCTURE

As previously mentioned, our case study analysis consisted in three different phases: the first one being a contextualisation of the social and culture context of each case study, followed by an analysis of five communication examples from the brand associated with our case study, and finally a crosscheck between the results acquired in the two previous phases.

To set some structure and boundaries to the analysis of the communication of each of the brands, that is the second phase of each case study, and considering our research question, we placed some guidelines. The communication examples that we analysed consisted of four different typologies: print campaign, invite, campaign video and video of an event. Due to the range of typologies, it would not be appropriate to set rigid guidelines. Previous to the analysis per se of each communication example we tried to gather some basic information, depending on the typology:

- Print campaign: release date, type of product, photographer, mean of publication and agency responsible for it;
- Invite: date, event, site of the event and authorship ;
- Campaign video: release date, type of product, photographer and agency responsible for it;
- Video of an event: year and site of the event;

That said, our analysis of each of the communication examples was developed using the respective case study as reference and trying to withdraw, from its shape and content, the

message that is being conveyed. All in all the aim of this analysis was to identify five key messages from each of the communication examples that we examined to compare them with the five main ideas identified in the first phase of our case study.

### 3.3. CASE STUDY 1: MARY QUANT AND THE ARISING OF THE MINISKIRT

**Phase 1: Contextualisation.** Cawthorne (1998, p. 110) stresses the importance of the social context of the period as he describes Dior's New Look, the silhouette that preceded the miniskirt, stating that "the New Look, was mature and sophisticated, giving an exaggerated nipped-in hourglass shape to women, which was not appropriate for young women of the newly emerging post war generation". The author defends that for the first time the youth felt the need to establish their persona and style within society, giving way to the birth of the teenager.

This new age group preferred a more practical and relaxed style wearing clothing designed for everyday wear, which led to a progressive simplification of the skirt (e.g. the trapeze dress, designed by Yves Saint Laurent and the A-line dress, designed by Christian Dior).

However, according to Cawthorne (1998) the designer that encapsulated the spirit of the era most successfully was Mary Quant. She started with a store called Bazaar in London where she sold accessible clothing with a simple design (e.g. sleeveless dresses and dungarees), inspired by the youthful style of British university students.

In 1965 the designer raises the hemline of her designs substantially, creating the piece that she became known for: the mini skirt. Cawthorne (1998, p.115) states that "the miniskirt perfectly complimented the clean cut look of The Beatles, the excitement of sexual permissiveness and the confidence of the new young woman", adding that "it was an instant success, epitomising the

spirit of London in the mid-60s; free, energetic, youthful, revolutionary and unconventional."

The success of the mini skirt led to appearance of a new style associated with it. With an emphasis on the legs, the miniskirt was usually paired with knee-high boots, bright colours, and textured or patterned tights also in vivid contrasting colours. Even though the hemline of the mini skirt added a sexual notion to clothing, with materials such as vinyl and PVC being often used, the miniskirt is mostly associated with a juvenile, pre adolescent, androgynous look, very exploited by the advertising, beauty and fashion industry, with the model Twiggy becoming the face of the decade (Cawthorne, 1998).

According to Cawthorne (1998), the emergence of this style and the innovations propelled by British designers such as Mary Quant, led to London taking Paris's place as the epicentre of fashion in the sixties.

Main ideas: youthful; pragmatic; female emancipation; enthusiasm, provocative

**Phase 2: Communication Analysis.** Started by gathering different types of communication from the brand Mary Quant, looking to examine the many ways in which the brand communicated with its audience and the how they came around to doing it. As so, we selected the five following examples: (A) print advert for Mary Quant's beret line, (B) print advert for Mary Quant's make-up essentials, (C) print advert for Mary Quant's nail polishes, (D) print advert for Ginger Group's Terylene dresses and (E) footage from Mary Quant's first shoe line launch.



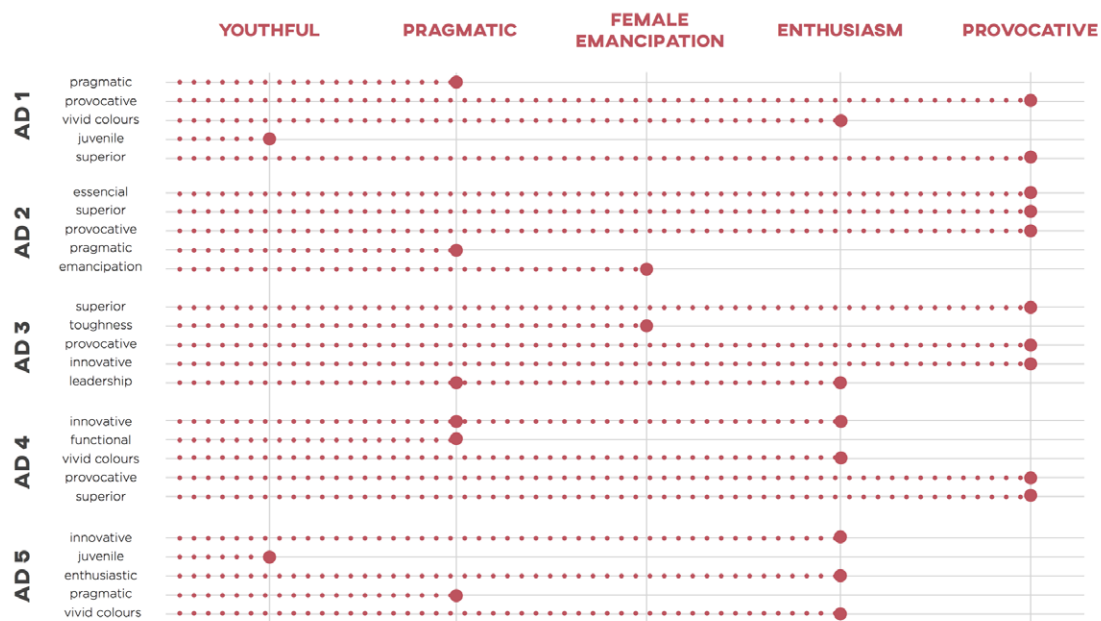


Fig. 4. Crosscheck between the main ideas identified on phase one and the key messages pin pointed on phase two

A	B	C	D	E
Pragmatic	Essential	Superior	Innovative	Innovative
Provocative	Superior	Toughness	Functional	Juvenile
Vivid Colours	Provocative	Provocative	Vivid Colours	Enthusiastic
Juvenile	Pragmatic	Innovative	Provocative	Pragmatic
Superior	Emancipation	Leadership	Superior	Vivid Colours

Fig. 3. Mary Quant's adverts and brand communication examples, and the main messages conveyed by them

### Phase 3: Main ideas and key messages crosscheck

#### 3.4. CASE STUDY 2: VIVIENNE WESTWOOD'S INFLUENCE AND THE PUNK MOVEMENT

**Phase 1: Contextualisation.** According to Cawthorne (1998), the punk movement emerged as a reaction to the lack of enthusiasm that the members of this movement - whom the author calls style politicians - felt towards the society and culture that surrounded them. For the young pioneers of the movement, the positive and enthusiastic approach that dominated society at the time meant that they had to resort to shock tactics to "get society to acknowledge the innate violence and brutality underlying the niceties" (Cawthorne, 1998, p.146).

However, the author defends that, contrary to common belief, the punk movement isn't based on ideas of revolution or utopia, having only emptiness and chaos at its core. Therefore

the members of this counter culture embrace a careless attitude, which they express by neglecting society's rules and norms and adopting a cynical approach towards the social context that surrounds them.

Nonetheless, Hebdige (as cited by Barnard, 2007) believes that even though chaos represents a fundamental portion of punk culture, in this specific case, chaos isn't directly related with lack of organisation. The author defends that "the punk subculture, then, signified chaos at every level, but this was only possible because the style itself was so thoroughly ordered" (Hebdige, as cited by Barnard, 2007, p.263).

According to Hebdige (as cited by Barnard, 2007), being a subculture, the punk movement had a number of symbolic objects, such as clothing, language, music, and interactions that connected and united the members. According to the author, when referring to the punk movement, fashion,

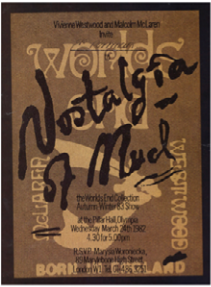




A	B	C	D	E
				
Appropriation	Contestation	Provocation	Provocation	Revolution
Revolution	Tradition	Defiance	Taboo	Political Affirmation
Dirt	Technology	Appropriation	Inclusiveness	Organised Chaos
Shock	Taboo	Organised Chaos	Political Affirmation	Provocation
Contestation	Organised Chaos	Shock	Contestation	Climate Change

Fig. 5. Vivienne Westwood's adverts and brand communication examples, and the main messages conveyed by them.

and most specifically the influence that Vivienne Westwood had on it, is a topic that needs consideration. Cawthorne (1998) stresses the importance that clothing had in the identification of punks, and states that the moment an item of clothing became associated with this movement, it acquired a new meaning within the social context. Therefore, Hebdige (as cited by Barnard, 2007) states that punks would often resort to appropriation and re-connotation of everyday objects, symbols from different cultures, or key items of clothing from the past, like what Westwood did to the Victorian corset. According to the author, for the members of this movement, “the forbidden is permitted, but by the same token, nothing, not even these forbidden signifiers (bondage, safety pins, chains, hair dye,

etc.) is sacred and fixed” (Hebdige, as cited by Barnard, 2007), hence why they often resorted to taboo topics, materials, and objects to use their appearance as a mean of social impugment.

Main ideas: contestation; provocation; taboo; organised chaos; appropriation.

**Phase 2:** Communication Analysis. Similarly to the first case study, we started by gathering the following advertising and communication examples: (A) Vivienne Westwood’s Nostalgia of Mud invite, (B) Video of the AW 1983 Vivienne Westwood show, (C) Vivienne Westwood and Andreas Kronthaler’s print advert, (D) Vivienne Westwood and Andreas Kronthaler’s print advert and (E) Vivienne Westwood’s website homepage.

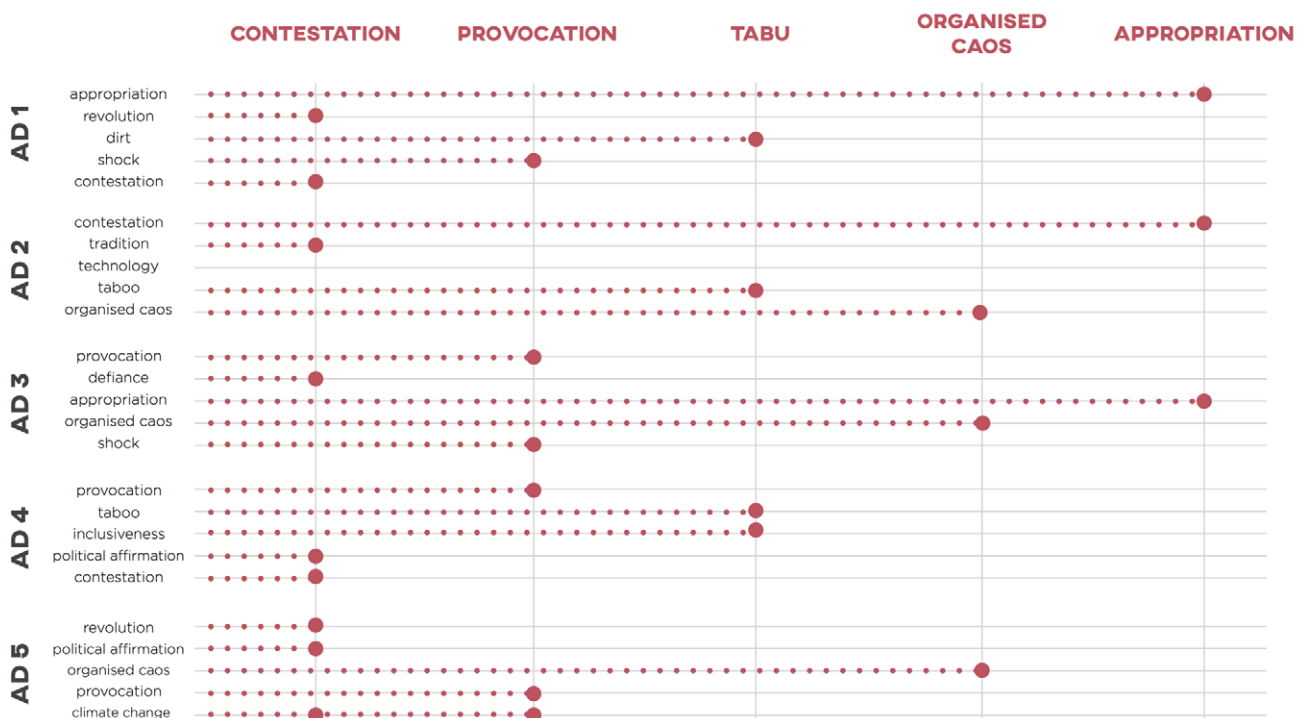


Fig. 6. Crosscheck between the main ideas identified on phase one and the key messages pin pointed on phase two.

**Phase 3:** Main ideas and key messages crosscheck

### 3.5. CASE STUDY 3: THE IMPORTANCE OF JOHN GALLIANO AND THE GENDER FLUIDITY TRENDS

**Phase 1: Contextualisation.** Crane and Bovone (2006) defend that clothing has always represented a mean of expressing personal image, as Davis (1992) states that clothing transmits symbolically the identity of its user, portraying how he wants to be seen by society. As various factors influence and dictate how one dresses, such as age, culture, and social status, Paoletti (2015) believes that through the years, gender has been one of the most defining ones. The author continues by stating that what's considered to be masculine or feminine has a great impact on the way people dress. Kaiser (1997) notes that both the beauty and fashion industries are deeply connected to a feminine notion, making so any male interested in it considered possibly an homosexual. Nonetheless, Cawthorne (1998) stresses that there were a few moments in the twentieth century towards gender blurring. According to the author, the First World War made so women started to take on tasks previously performed exclusively by men, allowing them to use, for the first time in history, trousers as everyday wear. He continues, by mentioning that in the 20's and the 30's some women such as Marlene Dietrich adopted trousers, and even suits, a style then known as the Eton, but they were seen as outcasts. It was only in the 60's and 70's that the rise of androgynous trends led to women fully adopting trousers as part of the wardrobe. However, Arnold (2001) believes these trends weren't related to androgyny since they were merely based on women adopting a male stereotyped look. Contrary, Cawthorne (1998) states that these same trends applied to both males and females. Cohn (1971) agrees, stating that the Peacock

Revolution from the 60's had a strong impact on the way men dressed, introducing a slimmer silhouette, more colour, and different textures and materials, with David Bowie as one of the icons of the movement. Similarly, Cawthorne (1998) mentions the male look of the 70's, in which, as a consequence of the hippie movement, men adopted longer haircuts and platform shoes; and the power suit adopted by women in the eighties as a way of marking their ground in male-dominated markets.

Nevertheless, Madsen (2018) states that perhaps as an evolution in the mentality of fashion designers, gender neutrality was never as present in fashion as in the 21st century. Newman (2019) defends that they are creating based on the evolution of society, and the Millennial and Gen Z tend to reject gender stereotypes, feeling that they represent a means of conditioning personal expression. Madsen (2018) mentions John Galliano, creative director of the house of Maison Margiela, as a leader of the movement, highlighting the show that followed the launch of their perfume Mutiny, where testimonials of transsexuals, intersexuals and transgender, actresses, singer and models were projected. Galliano himself said that his purpose was to erase gender conceptions allowing the audience to dream independently from their gender or connotations typically made with clothing.

Main ideas: gender fluidity; inclusiveness; individual expression; revolution; duality.

**Phase 2: Communication Analysis.** As done previously, before starting our analysis, we started by gathering some examples of communication from the brand, Maison Margiela, where John Galliano is currently creative director of: (A) Maison Margiela magazine cover for Another Man, (B) Video advert for the perfume Mutiny by Maison Margiela, (C) Print advert for the perfume Mutiny by Maison Margiela, (D) MM6 by

Maison Margiela print advert, (E) Video of the SS 2019 Maison Margiela show.

A	B	C	D	E
Duality	Individuality	Identity	Gender Fluidity	Revolution
Inclusiveness	Revolution	Ripping	Inclusiveness	Technology
Contestation	Ripping	Colour Features	Juvenile	Gender Fluidity
Taboo	Personal Acceptance	Gender Fluidity	Identity	Freedom
Gender Fluidity	Duality	Duality	Proximity	Inclusiveness

Fig. 7. Maison Margiela's adverts and brand communication examples, and the main messages conveyed by them

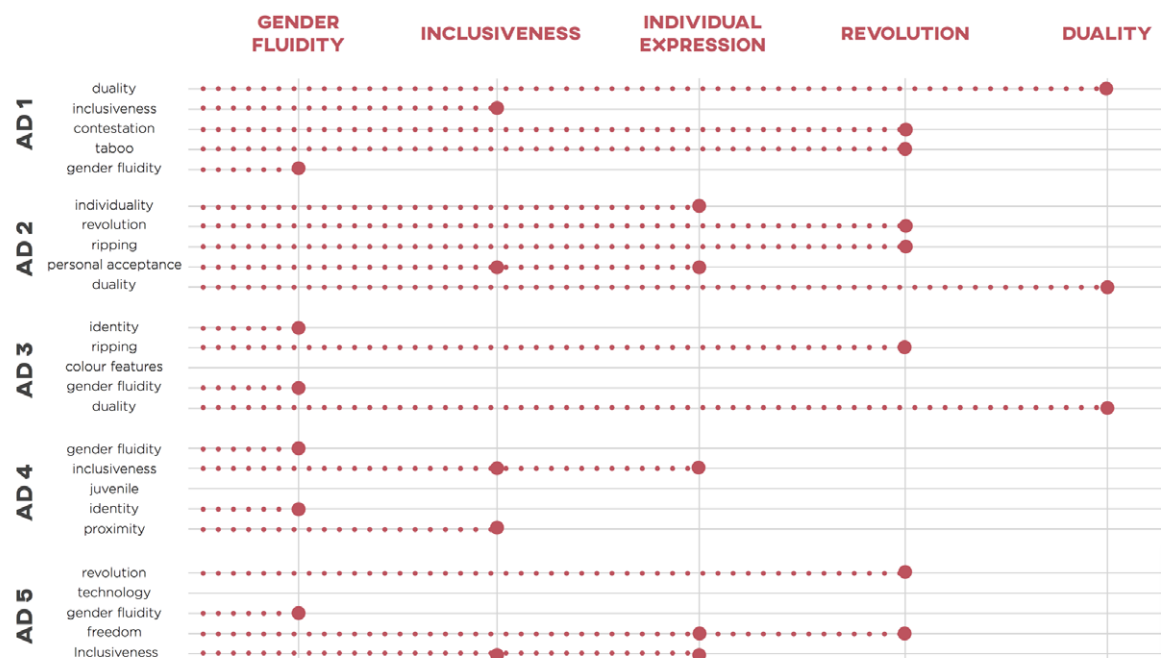


Fig. 8. Crosscheck between the main ideas identified on phase one and the key messages pin pointed on phase two

**Phase 3:** Main ideas and key messages crosscheck

## 4.CONCLUSIONS

Based on our research we were able to study how the advertising or communication of the brands selected as part of our case studies, reacted to the moments of change and innovations in fashion propelled by the social and cultural context.

The contextualisation of each case study allowed us to address one of our secondary questions by pin pointing some of the main ideas that led to such moments of change within fashion: the miniskirt appeared as a consequence of a time of enthusiasm and provocation, where pragmatism, youthfulness, and female emancipation thrived; the punk movement emerged as a counterculture, challenging the norm and forcing society to recognise imperfection and negativity within itself; and finally, the gender fluidity trends came to be as a result of a more inclusive and open-minded generation who believes in gender neutrality as a way of boosting diversity.

The analysis of the communication examples of each brands allowed us then to answer our other secondary research question, identifying the key messages being propelled by the brand: Mary Quant adopted a provocative tone, very pragmatic and enthusiastic, as Westwood takes on a rebellious tone, provocative and taboo, and Galliano calls for a gender revolution, promoting inclusiveness and diversity.

Finally, the crosscheck between the main ideas and key messages previously identified allowed us to answer our main research question and come to the conclusion that considering our three specific case studies we can, in fact, state that the communication of these three brands was influenced by the social and cultural change within fashion.



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# Narrative dimensions supporting the visual communication of contemporary brands

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## Abstract

Bal argues on how narrative is “the most widespread semiotic mode of expression” (2016: 101), commending its social relevance, as it is pervasive to most human communication techniques. Postmodernism recognises that human perception and interaction are necessarily subjective, and that constant change, ubiquity and mobility are the status quo. At the end of the 20th century, the so-called new media allowed a large quantity of information to move around within innumerable interconnected nodes, necessarily affecting how we understand narratives. Hypertextuality emerges in its open-ended and ever-developing fashion (Riffaterre, 1994). By the end of last century, some authors propose non-conventional narratives, hyper-novels, in which the story unfoldings are virtually infinite and where the reader becomes an interactive participant in the narrative (Cotrupi, 1991). Contemporary brands – that adapt to the context in which they operate – embrace a level of flexibility that allows them to develop and closely accompany a constantly evolving world, hence disregarding the need of a strictly consistent approach (Lélis, 2019). In the early 2000s, Kreutz (2001, 2005) identified two main visual brand identity systems: the Conventional, which main characteristics are standardisation, linear progress and fixedness, and another one that the author categorised as Non- Conventional or Mutant Brand Identities, where brands would present as flexible, dynamic, plural, fragmented and heterogeneous, i.e. postmodern. Following the assumption that a brand is a live construction (Neumeier, 2006), the objective of this ongoing research is to identify how contemporary brands approach narrative through their logos. Hence, the research question guiding this research is: what are the narrative dimensions structuring the communication of brands’ visual identities? This research followed an inductive reasoning aiming at adopting a post-structuralist perspective in order to deal with puzzling facts that emerged in the recent years, while the researchers had encounters with empirical phenomena that were not being explained by the existing range of theories. The method consisted of a qualitative hermeneutical content analysis. Because the discursive dimensions defining narrative in the context of visual identity have not been identified nor organised, the utmost goal was the identification of such main narrative dimensions in contemporary brands. The working framework is grounded on Lotfi Zadeh’s Fuzzy Logic (1996), which supports approximate modes of thinking rather than exact ones, acknowledging the virtues

of imprecision, very much common in human life complexities. The proposed dimensions were created to simplify the immense corpus on narrative theory, combining it with the scarce literature on visual narratives and intersecting it with the notions of brand storytelling and the current practice of visual identity communication. The starting point was the analysis of a wide range of dynamic/mutant brands in order to identify the minimum structural requirements for their logos to be considered a narrative. The identified elements were grouped and allowed the emergence of six dimensions: Hierarchy (Nuclear - Peripheral), Linearity (Sequential - Non-Linear), Predictability (Anticipated - Open-Ended), Longevity (Temporary - Permanent), Interactivity (Interpretative - Appropriative), Synchronicity (Asynchronous - Synchronous). This research provides insights for professionals to look at how visual identities' dynamic positioning can be successfully implemented without affecting recognition, whilst establishing or maintaining customer loyalty via synchronous or asynchronous imaginative practices, retrospective, interaction, appropriation, all structural and vital elements in a contemporary visual identity narrative. So far, the value of this research resides in the identification and definition of the six main narrative dimensions of logos in contemporary brands, with the potential to allow a benchmark tool for a) better aligning the creative brief with the client's needs, and b) the extended benefit of increasing brand engagement and meaningful brand experiences by designing the most structurally appropriate visual storytelling.

**Keywords**

**Narrative dimensions, communication design, visual identity, storytelling, contemporary brands**

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# Semiotic thinking: a creative process as an intersemiotic trajectory

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## Abstract

This paper intends to analyze the design thinking from concepts established by Charles Sanders Peirce in his literature coining, from such analysis, a new possibility of a creative process that takes into account the design as an intersemiotic trajectory. In this sense, designers are understood as actors who seek the multiplicity of languages which guides the materialization to “open entities exposed to uncertainty and incoherence” as classified by Zingale (2016). To realize this materialization, many designers use the components of empathy, definition, idealization, prototyping, and test given by design thinking and that can be understood, respectively, under the concepts of possibility, immediate consciousness, prediction, embodiment and causation from Peircean theory. In this regard, it can be understood that design thinking regulates a creative process mode and that often can not take in theoretical consideration the object of representation as a sign of experience obtained in the act of interpretation. Therefore, it is proposed here a theoretical-methodological proceeding of a new creative process that conceives the product developed by a designer as belonging to an idea that is not in mind and must be incorporated to achieve its completeness, that is, an idea that was about to receive embodiment and to act in the world, what Peirce calls a being in futuro. This process is called semiotic thinking, and with it, it is possible to enable designers to understand their performances as discursive analysis in a practice of intersemiotic trajectory translating conceptual interpretation in the contemporary creative industry models. This management of languages in the creative process of designers must be understood as a producer of meaning in the interpersonal dynamics from the aesthetic experience that aims a concept that can be expressed in a conditional proposition. This means that the intersemiotic trajectory of a designer is an endemic procedure of semiosis and a cognitive practice that enables semiotic processes of transference through mutable cultural contexts. This proposal will take into account the terminologies and specifications addressed by Peirce and gathered in their Collected Papers and Manuscript Catalog, as well as the reflections on the matrices and translations of languages developed by Lucia Santaella, Júlio Plaza, and Salvatore Zingale.

## Keywords:

Creative process, Intersemiotic trajectory, Design, Design thinking, Semiotic thinking.

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# How to measure the “inspiration” of an insight – an exploratory approach

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## Abstract

Despite being a theme still little addressed in the academic literature namely with regard to advertising, for professionals in the field, insight is a central theme in agencies (Ariztia, 2015). The term was popularized in the advertising industry in the 90s and was defined as something that the consumer identifies with, a “deep truth” about it, that induces a differentiating idea that aims to change their behavior (Coelho, 2014). Twenty-six years later, a study by (Parker, Ang, & Koslow, 2018) that investigated how account planners research and recognize quality insight documented a set of attributes and properties that determine their quality. Being still little explored and there are few works that address it, namely regarding its main characteristics and evaluation. The present work proposes to develop this theme, trying to present the vision of the creatives on this particular concept. What characteristics do creatives think an insight needs to be considered both as useful and of good quality? For this research, the methodology that was used consisted in a structured interview conducted with 12 reputable creative professionals in advertising agencies, in Portugal. As a result, in addition to a broad view of the concept in Portugal, the findings suggest four main characteristics that an insight must have to be considered as “inspiring”, that is, both useful and of good quality. First, the insight must be true, a faithful representation of reality. Secondly, it must be clear, that is, it must have the quality of intelligible. Third, it must be relevant to the target, being that the pertinence and implication that the insight represents to the consumer. At last, it must be original, as something eccentric that has never been seen. Also, it was uncovered that the way creatives look at insight does not differ from what previous literature says about the opinion of the account planner in the same sense of matter, therefore it may signify that problems that may exist will be more focused on behavior and communication rather than how insight is perceived within agencies. This short paper is part of an on-going study in which a method will be created and tested whereby strategic planners and creatives can measure the “inspiration” of insight, that is, by analyzing and evaluating the properties of characteristics of the insight, truth, clarity, relevance and originality. This future study seeks to contribute to the increase in the literature about insight in the advertising context by adding a still unexplored view of creatives and, also seeks to contribute to the improvement of the creative process by creating an instrument that will allow new synergies between planners and creatives in the pursuit of higher quality insight, eliminating communication barriers between them.

## Keywords:

Insight, Insight Evaluation, Account Planning, Creatives



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# Unexpected Design

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## Abstract

In 1994 I was asked to create a logo for a new Portuguese bank. We lived in times where the digital revolution, as we know it today, had yet little significance. One can say that the onset of the smart phone was still “ages to come”. Personal computers and specific software for graphic designers, such as Freehand, CorelDraw, Page Maker and Quark Xpress or Photoshop were in its advent. This would be a very different bank from all other Portuguese banks: it would have no offices for the costumers and function seven days a week all year round. All communication would be made, as far as institutionally possible, by telephone. On those days the telephone rotary dial and telephones with coil cords were still in use. New phones had arrived to the scene with digital dialling and cellular phones were in the brink. Through the early 1990s, cell phones mainly functioned for business. However, this was also a time when cell phone companies began to market their products toward the general public. This was the beginning of a significant change in consumerism within the telephone industry. It can be argued that the briefing for the job contained a flaw: there was no name for the product, the new bank. However, works on a visual identity had to begin immediately, regardless. The first successful sketch was inspired on the letters B for Bank (Banco in Portuguese) and the coil of the phones cord. The end result looked good and I was very happy. It seemed suitable to any name the bank could provide. On those days keeping up to date with what was being done globally in the graphic design field, as in most other visual fields, meant constant upgrading with the acquisition of books on the subject or long excursions to bookshops to have a glimpse at the latest books and magazines. To my dismay, on one of those magazines, I discovered that a Japanese bank had just launched a new logo very similar to the one I had just drawn. I went back to the recently acquired PC computer and after some more days of work, still with no name for the bank, I arrived at a new solution. This time it was inspired on the ten circles of the telephones rotary dial (Figure 1). With new graphic design software the deformation of shapes and figures was at the tip of our fingers and I very quickly came up with a form that suited perfectly my creative aspirations. Some days later the name of the bank came out: Banco 7 (Bank 7), an allusion to the weekly functioning. To great arousement the abstract form that I had initially conceived looked graphically very much like the number 7. The stakeholder approved the visual identity with satisfaction at the first presentation meeting. I would like to talk about serendipitous in design and the possibilities of producing graphic concepts regardless of a

complete pre-formed briefing. In paradox or as a complement to this “tale” I find that many times the direction we first endeavour as a creator find unexpected new and better paths.

**Keywords:**

**Aleatoric Design, Graphic Design, Logo and Logotype, Bank Symbol, Telephone**

# Graphic Design as a Means of Creating New Meanings in Digital Environment; Common Language of Everyday Life; emoji

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## Abstract

In terms of the history of civilization, the period in which communication technologies infiltrated into daily life was the new media age. New media and technologies have made 21st century people an individual from a global village, a part of the network community. Another discipline that enables these communication technologies to be used by the general user through an interface is the other discipline, which arises from the work of different disciplines such as software, product design, information and computer technologies. With the digital revolution, a new graphic design discipline was added to the efforts of people trying to communicate with societies from different cultures to form a common visual language such as Esperanto, ISOTYPE, Semantography and LoCos, which started in the 1800s. As a design discipline, graphic design, which has been in close interaction with technology since its inception, has used technologies from the pen to the computer as both tools and subjects. This interaction process also played a role in determining the visual language of the ages and cultures in different periods. Graphic designers sometimes use the technology of the age to break the rules of the past tense of this discipline, and led to the emergence of new rules. The products of this evolution have become more and more widespread in the new media era due to the nature of communication technologies. People from different cultures, languages, ages, education and income levels, who are connected to the network from all over the global village, experience this environment through a designed interface and express their feelings to each other with different design emojis (emo-icons) that social networks offer them. The main purpose of this study is to examine the universal visual communication language created by these pictogram based icons in terms of the evolution of graphic design discipline in this age. For this purpose, the selected samples were compared and compared with other common visual languages that took place in history in order to make contextual content analysis. At the same time, how the emoji sets examined were reshaped according to the demands of the users of the network society in different cultures and characteristics and the adventure of this transformation in terms of visual language were tried to be evaluated chronologically. In this perspective, the aim of the study is to evaluate graphic design through the emojis accepted as one of the common languages of the village in an interface-based visual communication environment in the global village to evolve the point it has evolved and to discuss it in the context of the new language of meaning.

## Keywords:

Graphic Design, New Media, Visual Communication, Cultural Interaction, Emoji

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# Multisensory and emotion: From communication to experience

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## Abstract

Today, the design of communication of a brand or a product, brand identity, seek to create user/consumer experiences that can promote human engagement with the respective brand or product, in a more intense way. Related to this perspective, the work of Nathan Shedroff (2001, 2009) in the field of experience design identifies different levels of value of a product or service, pointing that the qualitative dimension levels are the most valuable ones and produce a greater impact on the individual and his/her perception and engagement. Affective or emotional aspects, which integrate the qualitative dimension, are directly related to the most profound human decision-making features that conduces to the engagement and involvement of the user to a product or brand. Emotional connection represents a powerful strategy to create a relationship between brands, products or services and with consumers (D.U.B.V.C., n.d.; Shedroff, 2001, 2009). According to Norman et al. (2003), the visceral level is, of the model of affect and cognition three levels of processing, the one that most intensely and effectively moves us to accept or reject things and situations we are confronted with in our every day's life. At this level, reason or rational thinking is not involved: it is the most primitive dimension of processing, resulting in a "visceral reaction" of the human being. The communication materials that compose the universe of many brands, and characterize them (which are part of their identity), explore, increasingly, the emotional dimension in communication (Blasco-Arcas et al., 2016; Herman & Forehand, 2016; Rosebaum-Elliott et al., 2015; Wong, 2019), seeking to appeal to the deepest and often unconscious. These materials explore, namely, aspects related to what is more archaic or deep-rooted in the individual, such as universal biological aspects or interpersonal aspects (like emotional bonds) and which, strategically, seem to replace a more direct and straightforward presentation of the brand or product. Through a qualitative research methodology, focused on case study analysis, this article presents a set of selected cases of products/brand communication materials, from which we examine how the emotional dimension is explored and the communication is established with the individual, towards the promotion of an emotional experience. The analysis gives particular attention to the multisensory characteristics in the materials (Hultén, 2011; Janina et al, 2018; Wiedmann et al., 2018), associated with greater intensity of the experience and engagement: multisensory communication has a greater potential to trigger an emotional response in the individual, because it simultaneously stimulates several cognitive senses. From the analysis, we identify final considerations about the relationship of the emotional and sensory dimension in the communication of a brand or product, which

potentiate an intense engagement of the individual.

**Keywords:**

**Experience design, Brand identity, Emotion, Multisensory, Engagement**

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# The articulation between the memetic discourse, on social networks, and their materialization in the street of Chapecó city: first exploratory phase to approach the research field

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## Abstract

The symbolic and discursive exchanges promoted by speeches that emerge from digital platforms, constitute different social phenomena, which often result in new spaces of signification and social construction. It is noteworthy the movement that starts from the memes and the manifestations that materialize, from such speeches, gaining life in the form of posters, graffiti, protesting banners, among other expressions in the streets of the cities. This article incorporates a research project that seeks to analyze the collective imagination that becomes, at the same time, both digital and material in the expression of ideas, discourses, and ideologies, represented by memetic language in Chapecó city. The study considers the perspective that the subjects, who appropriate from the memes discourse, construct new spaces of signification and create territorial delimitations that, although changeable, are quite necessary for the constitution of collective intelligence (Lévi, 2000), p. 28). The context of the city and its representation is strongly demarcated by the visual dimension, which sometimes symbolizes the movement of existing records in different media, by different actors that make up the place identity fabric (Feijó; Oliveira; Gomez, 2018). Contemporary medias help create new senses of place and expand the construction of temporal space perception (Lemos, 2004). According to Fragozo; Recuero and Amaral (2011), the absence of materiality does not prevent virtual places from unfolding and causing feelings of possession and belonging in users, characterizing an identity link associated with the places. The understanding of the identity social imaginary must be accomplished from 'readings of the place', in the plural, so that this place can be represented or imagined from different looks (Hall, 2014 & Lynch, 2011 & Sanchez, 2010). The initial stage of the research project will be developed in this study, in which the initial data will be extracted, catalogued and analyzed from the traces left in the digital environment. Such traces will be identified from the hash tags related to the city found on Instagram, considering memes that may be materialized in the environment of Chapecó city streets. It is sought to grasp the articulation between the memetic discourses on social networks and their materialization in the streets of the city, in the construction of collective imagination online and offline. A multi- methodological approach will be used (Iglesias & Alfinito, 2006), supported by the assumptions of the Grounded Theory (Glaser and Strauss)

in which the theory must emerge from data, enabling consistent observation, comparison, classification and analysis (Fragoso et al., 2011). It is the first exploratory phase to approach the research field, with an ethnographic perspective, from a classic and virtual point of view. Ethnography is based on observation and classification of phenomena that are all around us, from a deep immersion in the peculiarity of that search. This initial stage will be held from October 2019 to March 2020 and the images obtained will be stored, creating an index of identification, description, and reference, so that they can be also searched in the offline environment. The previous results of the collection constitute this study corpus, where analyses will be carried out, by using morphological analyses of content (Bardin, 2016). Therefore, it is expected to obtain an initial understanding and insights on how the articulation between the memetic discourse, on social networks, and their materialization occur in the street of Chapecó city.

**Keywords:**

**Memetic, city identity, digital platforms, social imaginary, city image.**

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# Will Digital Designers Replace Humans? The Use of Artificial Intelligence in Graphic Design

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## Abstract

The use of artificial intelligence algorithms in graphic design is already a reality. Reactions to this new reality are diverse: some graphic design professionals are reluctant, skeptical and even afraid, others are enthusiastic and believe in a positive future. The fact is, regardless of opinions, we all must be prepared and educated to face the future that is already here. Decades ago, there was concern about the increased competition when the landscape became international, globalized. Now we are living a new moment and the question is: can artificial intelligence replace human designers? I will describe here some of the possibilities in this new scenario of AI in graphic design.

## 1. INTRODUCTION

The 4th Industrial Revolution, the age of cyberphysical systems, will bring change at a speed, scale and strength unlike any we have experienced before. It will affect the very essence of our human experience. Today, we know that all of these innovations will bring radical changes to all systems in just a few years, the interaction between fields such as nanotechnology, brain research, 3D printing, mobile networking and computing will create realities that were previously unthinkable. According to Schwab, K. (2017), access to technology will spread rapidly and widely, making many tools capable of promoting the invention of new products and services quickly and inexpensively. The current business models of all industries will be transformed. Therefore, professional training and practice in all sectors of our society will inevitably undergo profound changes, including the craft of design as a whole.

Today we see the increasing insertion of AI algorithms at different levels of the creative processes previously known and applied by us. This new way of designing has proven to be very positive, prompting us designers to adapt to this reality. We need to understand what are the limits of this new technology and how we should prepare ourselves to face it.

## 2. ARTIFICIAL INTELLIGENCE IN LOGO DESIGN CREATIVE PROCESS

Jon Gold, a designer and technologist whose focus of interest is the intersection between Artificial Intelligence and the creative process, contextualizes this moment: “Decades later we seem to be breaking into another era. The most exciting and intellectually stimulating years in the history of our industry; the peak of the real designer-computer symbiosis. We are on the verge of another revolution as it has been almost three decades since the First International Conference on Artificial Intelligence in Design held in Edinburgh (June 1991). Deep Learning is trying to make the quantum leap in the field of graphic design.”

Digital tools applied in creative design processes are numerous and indispensable, and many of them are already provided with AI. Embedded in their codes, these algorithms are capable of automatically generating color palettes and photos, analyzing separate data from millions of images and videos available on the web, or even helping non-designers to create a website. Face recognition is enabling users to select and edit human faces in photos. The AI also generates visual content by blending styles and image content, enhancing low-quality images, combining simple drafts with drawings by talented artists, using photo and video filters, and even more resources, many of which are available for free use.

Considering all the fuss about AI-driven graphic design, today's reality is still far from the big vision. Improvement and study are needed so these modern tools will be in fact increasingly useful in the future. But the hype about the Artificial Intelligence superpower being able to completely replace human designers makes expectations too high and even fanciful today.

## CONCLUSION

Will digital designers replace humans?

AI aims to get a lot of routine work off the shoulders of designers. Designers are faced with tedious day to day tasks. Examples may be product localization or creating the same graphics in multiple languages. It is expected that at least in the near future, bots will not be able to make independent decisions about the appearance of the final product in graphic design.

According to Paula Scher, one of the world's most influential graphic designers, assistance from IA and Machine Learning (ML) will not prevent professional graphic designers from wanting and needing to “make aesthetic decisions about retouching and typography.” At the same time, Scher acknowledged that “entry-level jobs can be lost” with software becoming more widespread and sophisticated.

Consequently, people will no longer be users of technology. At the same time, this does not mean that technology will dislodge us. Instead, we will become mentors. Humans can guide their tools and guide them through the necessary tasks. In this world, design work will become more like curation and management. Tools will propose designs, designers will decide what works.

AI is an extension of what humans can already do. It may be complex on the inside, but it is simply a tool that makes things better. It can work faster, consider more complex systems, and evaluate many other variables. Then the prediction is that AI will enhance and speed up creative processes, and designers will be able to choose and approve adjustments. Theoretically, this would free up our time for more creative tasks.

With the evolution of artificial intelligence, designers will be able to create shapes that would be impossible for a human to build. This will make their work better by suggesting incremental

improvements based on a deep understanding of their inspirations and influences.

At the same time, these same designers will be advised to be incorporated into engineering and coding teams. This would help keep AI and ML efforts real and keep designers part of this imminent future reality. Of course, designers must always be up to date not only on current technological innovations, but also on future design trends.

Past experience has shown that generative technologies have already significantly changed other industries. Game architecture and design are good examples. But change doesn't mean job loss for creatives. Instead, a new era of technologically enhanced creativity is just beginning.

The fact is that today when we approach the subject of using Artificial Intelligence algorithms in graphic design, some professionals are reluctant, skeptical and even afraid, others are enthusiastic and believe in a positive future. Regardless of opinions, we all must be prepared and educated to face it, according to Daugherty P. and Wilson H. (2018).

#### **Keywords:**

**Algorithm, artificial intelligence, graphic design, creative process, logo**

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# Track

## Design for Innovation, Management and Services

*Innovation, services and management are now accepted areas of design research and design practice. All three areas cross from private into public organizations, concern business, public sector and social innovation; reach from design management to public management and challenge us to envision what a service may mean, look and feel like in a rapidly changing world dominated by digitalization and sooner rather than later, artificial intelligence. The track "Design for innovation, services and management" seeks contributions from authors who link research in service design with research in design management and one or more areas of innovation (business, public sector, or social). We are interested in looking more closely at: (i) the role of human-centered design in this; (ii) the implications, regard (or disregard?) of Sustainable Development Goals; (iii) emerging new areas of practice and research (i.e. design for policies); (iv) the overall body of knowledge (literature) that exists; (v) the gaps in research and literature.*

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# Designing Cross-Scalable Infrastructures

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## Abstract

The »socio-material infrastructures« consist of material and immaterial elements, which help to understand certain complexities of our surroundings. The structures also give insights on how the »flows« of information or resources are circulating or not. They reveal who is part of the infrastructure and which actors are left behind – and therefore excluded from certain advantages that are mostly the results of digital communication platforms. Thus, this theoretical concept can help designers to understand how to tackle the digital divide in a more effective manner.

This paper shows not only the theoretical framing of the »socio-material infrastructures« concept but also reveals the transfer to practice within two cases that are different in context, and similar in objectives. In the research projects, technologies were developed with and for specific underrepresented actors, as citizens affected by certain local issues. For these actors, new technological solutions were developed to let them be part of certain processes and to change their situation from the current to a preferred one. Thus, they were involved in the development process of these technologies, which were published open-source or using open data. Through these cases, we witness that technologies serve as enablers, which are utilized and adapted by the user itself, through which a digital common can evolve.

This paper explores how those citizen-based technologies can be turned into a glocal enabler for not only some but for many. Therefore, cross-scaling strategies need to be explored and developed, which will be the final discussion of this paper.

## Keywords:

**Socio-material Infrastructures, Digital Commons, Glocalized Networks, Cross-Scalable Infrastructures, Civic Design**

# 1. INTRODUCTION

## 1.1 UNDERSTANDING THE THEORETICAL CONCEPT OF SOCIO-MATERIAL INFRASTRUCTURES

When positioned in the area of social and political design, often contexts need to be explored with highly complex structures, changing parameters, as well as shifting influences from outside. Within this »global space of flows and local space of places« (Castells, M. 1996), designers rely on approaches on the one hand side to fulfil their responsibility towards the involved actors in real-life settings, and on the other hand side, they draw on approaches which have the ability to build long-term, resilient structures, withstanding outside influences.

For this crucial need, the approach of »socio-material infrastructures«, was coined by Star and Ruhleder in 1996 (Star, S. L. & Ruhleder, K. 1996). They also introduced a term for the process while building a framework, called infrastructuring. The framework itself is flexible and stable at the same time, as well as understandable from different perspectives. Thus, people can use and adapt it in multiple ways and through that gain insight into different aspects of a structure, whether to be a small scale or a big scale. The framework is able to weave into already existing and known structures but is still open enough to adapt fast-changing parameters from the outside.

The concept of socio-material infrastructures was also emphasized through the actor-network theory developed since the 1980s. This paper especially draws on the perspective of Latour (Latour, B., 1996). In his theoretical analyses, he is emphasizing that the frameworks consist of forming arrangements and correlations, which he calls assemblies (Latour, B., 2005). Hereby every single element and relation in-between needs

special care – otherwise they would disappear and leave the framework.

Pelle Ehn transferred the concept in 2008 (Ehn, P., 2008) to the design discipline and combines Stars and Latours perspectives. An infrastructure consisting of human (individual humans, collectives) and non-human actors (physical and/or digital elements), forms to aim towards a common activity, like Ehn and his research group A.telier empirically tested it in the research project of the Malmö Living Labs (Binder, T., et al., 2011).

Ehn also suggests an underlying model of the often challenging aspect of time within growing complexities in project durations (Ehn, P., 2008): with his concept of Design before, during and after project time, it helps to understand, that the first phase of a project should contain a deeper analysis of the given structure, consisting out of material and immaterial elements, to decide where to start the project itself. When this is done, it needs to be taken into consideration, how to build upon the already existing structure and extend it to the purpose of those, who should be involved and included in the given structure – and through that counteract the social and digital divide (van Deursen, A., & Helsper, E. J., 2015). Through the approach of socio-material infrastructures also transparency and clarification towards the involved actors, emerge. Additionally, it makes the often intangible and visionary social practice communicable. Through that also expectations of involved non-designers get lowered and more realistic estimation of time and change is possible in the given amount of time. All these aspects are important in the phase during project time.

But also, the phase after project time is crucial

for the infrastructuring approach. It helps to let the involved actors understand how to continue the activities on their own. It also helps to share responsibilities for those involved, by the identified elements and relations. Especially the Design after project time is important to transfer the research insights to other contexts and make it accessible to a broad range of actors. For that especially the approach of cross-scaled infrastructures comes into play (Cash, D. W., et al., 2006), which describes the intended scaling to a higher number and variety of cases, in which a certain development is tested. Thus, the generated elements, e.g. open source technologies, are being used in different contexts, and through that, a broad range of insights is generated. The multiple usages and learnings from different actors make the concept more resilient and adaptable, regarding cultural, issue-based, or context-related adaptations. Also, the impact of the research grows exponentially through the cross-scaling of developed structures.

Another important aspect is the relation between the local and global dimensions, which is described in the related literature, starting with the »small local« and »long global networks« by Manzini (Manzini, E., 2006), pointing out that the small local connections are not less important. The local connections use the »long global networks« for inspiration and innovation on many different levels, but for sure this adaption also affects »back« and informs the global dimension. Castells (Castells, M. 1996) highlights that the constant influence of »global space of flows« on local spaces can also challenge these structures tremendously because they are torn between them and their own »local space of places«. Those *glocalized networks* (Wellman B., 2002) also show how dualisms, as between local and global, bottom-up and top-down or micro and macro, get dissolved. But how to deal with these dissolving dualisms and the increasing overlap

and interconnection in a world of flows?

Thus, this paper looks into two case studies which were using the theoretical concept of socio-material infrastructures and it explores the different dimensions of how to transfer and cross-scale the locally situated practices to a *glocal* dimension, through which a broader audience can profit from the locally and user-centered developed outcomes that range from digital to physical.

## 2. TRANSFER TO PRACTICE

### 2.1 LEARNING FROM THE EXPERTS OF EVERYDAY LIFE

In this paper, we present two case studies embracing the theoretical concepts mentioned in the previous section to find a common ground for possible cross-scaling strategies. Both case studies emerge based on local problems in two different countries (Germany and Italy) and propose bottom-up solutions enhancing, inventing and merging digital and physical infrastructures. Both case studies will get evaluated based on the same reflection categories, through which a more profound evaluation can take place considering the before, during and after design phases. Those evaluation categories also help to understand how the cross-scaling of infrastructures can work for a broad range of great local practices, which often stay local. With this paper, we want to emphasize the potential in those local practices, which can enable also practices in completely different cultural contexts. To understand and address the cross-scaling of infrastructures, we have developed the following reflection categories, which are, firstly, how to connect the existing with new build infrastructural elements, secondly, how to understand and reflect the in- and exclusion of actors within the given structures and thirdly, how to tackle the limited role of impact in local design

practices through the approach of cross-scaling, to be able to transfer the technologies to several autonomous communities and through that reach the status of a digital common.

## 2.2 CASE STUDY 1: PARTICIPATORY CITY BRANDIS (MIT-MACH-STADT)

In this one-year research project<sup>1</sup>, which was situated in Brandis, a 10,000-inhabitants town close to Leipzig, Germany, new and informal elements of civic participation should be tested out and implemented in a co-designed way. The goal was not only to reach citizens who were already engaged in local practices and initiatives but also to address and involve those citizens who are not yet engaged or involved in the public discourse.

After an intense analysis of existing structures and elements, a range of citizen workshops, local events, and public interventions were conducted. After half of the initial project-time, one key activity was a public intervention raising the discourse about the revitalization of the central market square. For that, a postcard was given to all households in the week beforehand. At the event, all participating citizens arrived with detailed, filled-out postcards, which could be posted in an installed Hybrid Letterbox, a formerly developed letterbox, which digitizes the hand-written cards some seconds after posting it. Through this widespread information and easy access to participate, combining existing communication structures as the public column, with new ones, as the hybrid letterbox, it was possible to reach citizens which were not reachable through monthly meetings of exchange.

After project time, not only a supplemented infrastructure was established, but also new elements, like open-source technology, were created and handed over to the local municipality as well as to the local actors.

## EVALUATION

### 1. Connecting existing and new build Infrastructures

Through the detailed analysis of the existing structure and the intense participatory process with some key actors of the local community, particularly representatives of existing initiatives, as well as the constant dialogue with the municipality, the already existing communication elements and the overall structure, consisting of face-to-face, physical and digital access points, were identified (see Fig. 1). Among those also digital elements were actively integrated, as an e-participation platform, with a developed framework by the ministry of interior, on which municipal data as construction plans, were published and could be discussed digitally. Some citizens, who were affected by the construction site or re-planning, looked at the maps, but almost nobody was using the opportunity to discuss it in digital space – those discussions were shifted to face-to-face meetings either private or within public constitutional meetings. Thus, the platform was almost not in usage.

The goal of the supplemented structure was to use the digital space at access points supportive to the community, and where they provide an additional advantage. Additionally, the single elements, as the e-participation platform, got connected to other elements as the Hybrid Letterbox (see Fig. 2) and thus, complementing and connecting the system elements. Moreover, the responsibility and maintenance of the single elements were spread equally between the

<sup>1</sup> This research project was initiated by the Design Research Lab, Berlin University of the Arts, and funded by the Ministry of Interior Saxony. The core research team consisted of Gesche Joost, Bianca Herlo, Florian Sametinger and Jennifer Schubert. [www.drlab.org/research-projects/mit-mach-stadt-3/](http://www.drlab.org/research-projects/mit-mach-stadt-3/) [retrieved Dec 20th 2019]

citizens and representatives of the municipality. Through that, a manifold communication structure between the citizens and the municipality evolved.

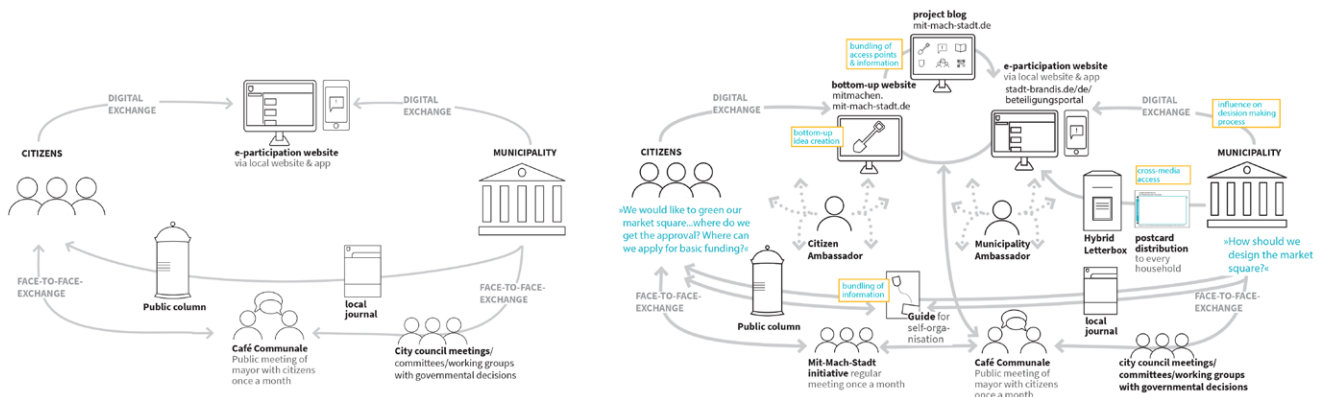


Fig. 1-2. The socio-material infrastructure before and after project-time at the Participatory City project.

## 2. In- & Exclusion of Actors

One goal of this project was to include citizens who were not regularly engaged in dialogue with public issues. For that, a basic dialogue with already engaged citizens was needed to understand the given local structures by monthly meetings. Through single, selective meetings, as the intervention of the market square, the not

engaged citizens started to formulate and reveal their opinions (see Fig. 3). The most important part was to prolong the single engagement to an extended and more involved role. For that, all information was evaluated and summed up in three feasible and fundable project ideas that could be selected on a follow-up event (see Fig. 4) plus using the e-participation platform in a more relevant manner. This track of action was handed over to the municipality.



Fig. 3-4. Picture of filled out postcards; picture of playful ballot.



### 3. Cross-Scaling for Digital Commons

Through the one-year research project especially the digital access points, as a bottom-up participation platform (see Fig. 5), tailored towards a digital organization platform for local events and meetings, should show how digital access points can support local structures and can activate less digital sovereign citizens. Besides, also a local history platform (see Fig. 6) was developed, which offers a mixed-media source of historical material offered by citizens to citizens. It also had a physical pendant in the town hall, which was extended with a “story corner” where citizens without access to the digital could record their local stories to complement the given physical material telling historical knowledge

about the city and the surrounding region.

Within the Brandis case study, it was emphasized how digital platforms can have a fruitful interplay and extension of physical activities. These kinds of platforms achieved a cross-local demand. Other local communities, within Saxony and across, were interested especially in those applications. For cross-scaling purposes, the open-source code of those digital platforms was published. For offering a meaningful contribution and transfer of open-source applications to other localities, a pre-planned research activity with capacity is needed to insert in the overall research plan. It is a requirement for fulfilling the demands of cross-scaled infrastructures and through that a broader range of insights as well as a higher impact in the social and political design field.

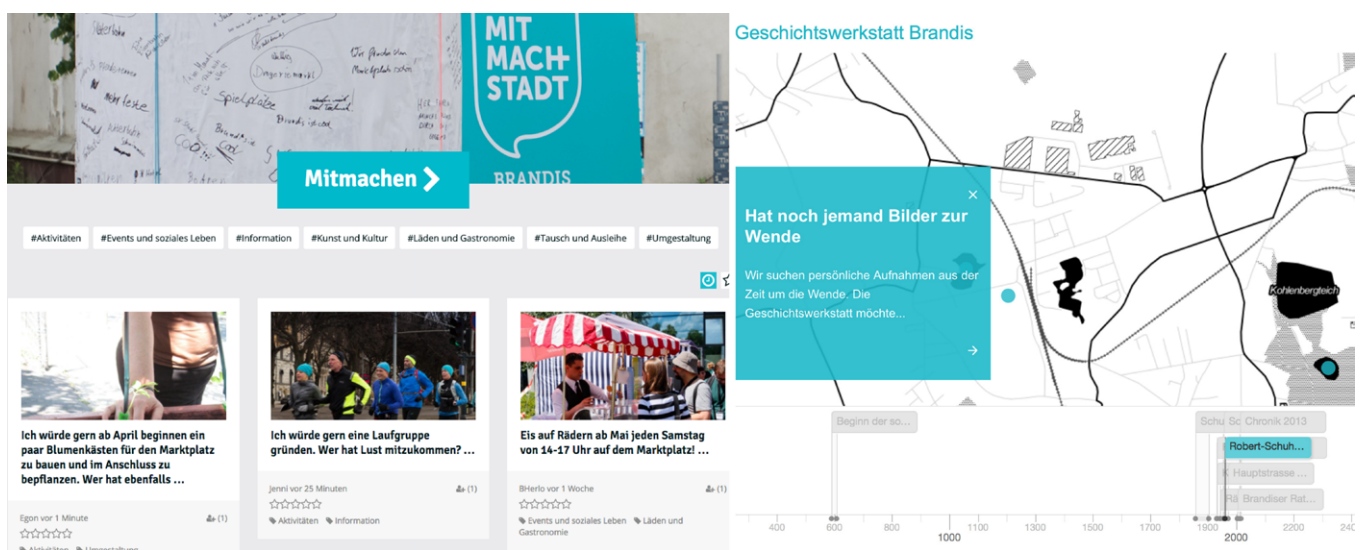


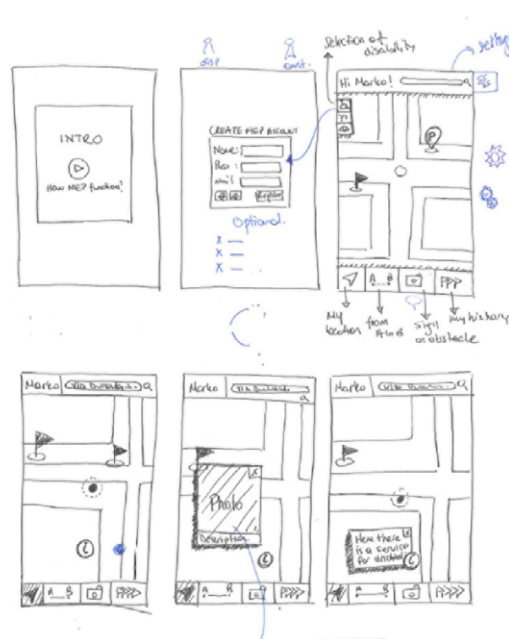
Fig. 5-6. The low-threshold participatory platform; the digital history archive.

### 2.3 CASE STUDY 2: MEP – MAPS FOR EASY PATHS

MEP (Maps for Easy Paths) is a multi-disciplinary project – funded under the Polisocial<sup>2</sup> program – to create digital-physical solutions for enhancing the accessibility of urban pedestrian areas

for people with mobility problems in Milan, Como, and its surrounding in Italy (Biagi, L., et al., 2017). It merges accessible street data collected by different participants with the help of digital tools in order to create an open system that can grow and evolve by each citizen's contribution. Starting from the existing socio-material infrastructures, the project aims at generating digital-physical tools creating new flows of data to enhance the infrastructures to be more accessible and inclusive. The project proposes four different tools: the MEP-Traces App to collect accessible street data by geolocation sensors in smartphones, the MEP-wear – a wearable technology concept – to collect data in a hands-free way, the MEP App to visualize the accessibility of city routes on a digital map and to report obstacles or barriers and finally

the MEP-act to turn these digital data into actions that can solve the accessibility problems of the city through co-design workshops with different stakeholders (associations, municipality, companies, citizens, design students, architects, urban planners, etc.). In the user-centered design process, both analog and digital means (see Fig. 7) were used in order to develop the App together with the participants through focus-group sessions in which different groups of citizens (manual wheelchair users, electric wheelchair users, and elderly people) were involved by expressing their specific needs. Once the App was ready to be tested and used in pilot areas, other user groups, such as school children were involved in the project for collecting accessibility data of their locations.



<sup>2</sup> A program of social responsibility of Politecnico di Milano, <http://www.polisocial.polimi.it/us/home/> [retrieved Dec 20th 2019]

Fig. 7. Analogue tools used for developing the digital version of the App (wireframe paper sketches, a public board for collecting accessible street data in an analogue way in a neighborhood in Milan.)



## EVALUATION

### 1. Connecting existing and new build Infrastructures

MEP project mostly gathers data by the citizens' participation but also becomes a melting-pot for other information about accessible services offered by the municipality and other private-public entities, that is otherwise dispersive (see Fig. 8). The digital tools developed in the MEP project allow citizens to have access to more enriched data about the accessibility of the streets. These new tools aim at being integrated into existing infrastructure, enhancing it through the contribution of the citizens as active data providers.

This project shows that a systematic approach is needed to tackle complex issues that can be

only solved by including the voices of multi-stakeholders and a wide range of participants. Besides the digital tools, the MEP-act initiative aims at turning the digital data collected with the Apps into tangible results. It brings the obstacles and barriers reported by the users onto the table to be discussed and solved through co-design workshops with different stakeholders (associations, municipality, companies, citizens, design students, architects, urban planners, etc.) (Bolis, V., 2016). This tangible part of the system brings a step further action on not only reporting the obstacles but also resolving them or totally removing them from the urban environment as seen in Fig.8. Hence, new tangible elements like urban solutions or new actors are added in the socio-material infrastructure continuously transforming and enhancing it.

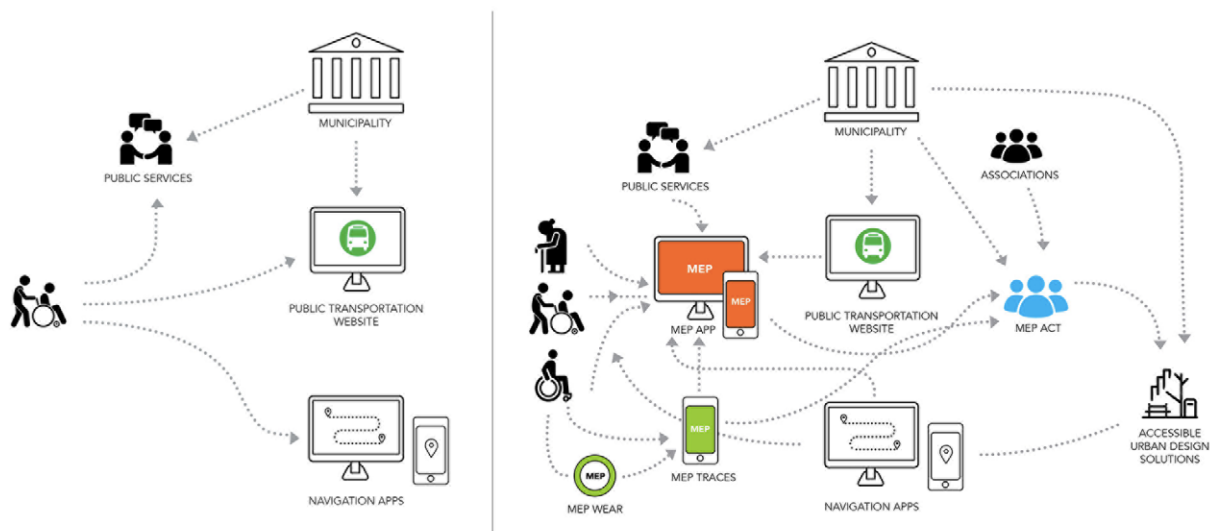


Fig. 8. The socio-material infrastructure before and after project-time of MEP project.

## 2. In- & Exclusion of Actors

The MEP App becomes a new digital element of the existing infrastructure while including and attracting more users about accessibility. At the beginning of the project, three focus groups (manual wheelchair users, electric wheelchair users, and elderly people) were conducted in order to involve the main users in design decisions and co-creation of the App starting from their ideas, needs, and values. These insights were reflected in the design of the App that became a digital tool for all citizens to not only visualize the accessible streets but also to contribute to gathering updated information. Besides users with mobility restrictions, the project brought together different actors such as middle school, high school, and university students that have systematically mapped their localities in order to contribute to the data collection. Therefore, besides enriching accessible street data, the project creates awareness of the problem of mobility by involving groups of citizens (schools, associations, volunteers) becoming active users by participating directly in the creation of content.

## 3. Cross-Scaling for Digital Commons

For achieving more significant results in citizen-based data collection, it is important that the tools are used by large groups of users. Being an open digital platform, the MEP app allows all its users to connect, share, utilize, and rate the information based on any location. Therefore, while the main starting point was a city in Italy and its surroundings, it can also foster communities in other parts of the world to map their city and use the same tool for solving their own problems about accessibility. For instance, it was observed that the MEP App has users from other countries, such as India. However, in order to understand its real impact in these new localities, there should be a deeper research

done. The openness of the digital tools on one side allows these spontaneous results and cross-scaling after the project-time, but on the other side, there should be a systematic work and a strategy behind to spread it to other communities who could sustain the system by the contribution and active participation of their own users.

## 3. REFLECTION

To be able to create digital commons (Ostrom, E., & Helfrich, S., 2011; Gosh, R., Malina, R. F., & Cubbitt, S., 2006) and long-lasting structures that could be used by a broad range of citizens in diverse local contexts, this paper aims at providing an approach that helps to express the conditions of durability and scalability of a local project. It is needed to expand the infrastructures with new elements, lift them from only one local context, and make them accessible by other actors and localities. The design discipline can bring new systematic solutions to go beyond the local practice and to offer results and insights to a broader community, expanding the local knowledge on a global level. This can be done through having a special focus not only *before and during*, but also after the project time in order to expand its impact to other localities while enhancing the infrastructure into a big network of information flows. Through that, a *glocal* discourse can evolve (Wellman B., 2002), which builds up the before segregated and not-connected discourse at many local places, which occurs not knowing from each other. Through digital commons, *glocal* knowledge exchange can be facilitated to lift the quality of local practices, help to extend the structure of the digital element, as well as providing knowledge about challenges and pitfalls for not being repeated.

The provided approach (see Fig. 9) represents how socio-material infrastructures with analog

and digital elements can be used by local actors to evolve them to *glocal* structures. The visualization shows the feedback flows between different localities in a cross-scaling situation. On the first level, the local pilot is conducted. The outcomes can be used by other local contexts, still with the possible support of the initiators of the pilot. After the first phase of conduction, even new projects can evolve through the cases at the other localities. Thus, the knowledge exchange offers the potential to provide elaborated structures through which initiators world-wide can use and adapt the outcomes. Through that also the initial makers can learn, adapt, and extend their repository and expand the pilot case. The information flow between new initiators and the pilot project conductors can happen through digital platforms that are also part of the design of new infrastructures allowing a fruitful knowledge exchange even after the project-time. Already open-source repositories and platforms offer this type of exchange between the users, however in order to make a more fluent information flow, new ways of knowledge exchange should be developed and considered as part of the system already before and during the project-time, which then allows a profound phase of adaptation, exchange of insights and comparing research

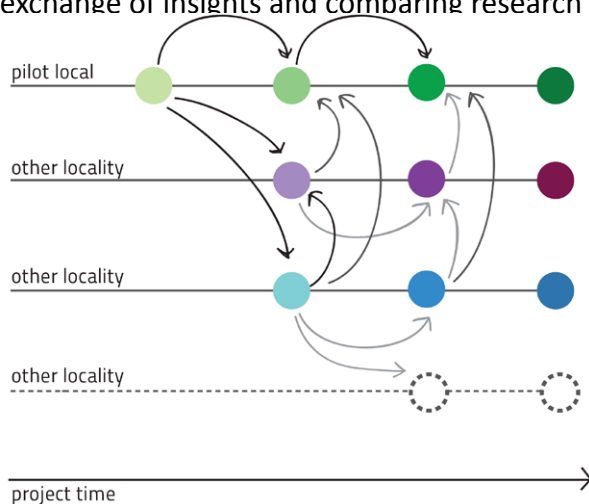


Fig. 9. The proposed model for cross-scalable infrastructures.

## CONCLUSION

The infrastructures in urban as well as rural space become dynamically evolving, enhanced, and enabled by the means of new tools bringing bottom-up solutions. The open-source digital technologies enable citizens to participate, debate, and – in the end – make a change in physical and digital infrastructures of our ever-evolving surroundings in order to make them better and inclusive for everyone. This paper aims at reflecting on how to design solutions that on one hand emerges from local realities, on the other hand, expands it to other places in the world in order to enrich the existing infrastructures through enabling citizens to have active roles for decision making or data gathering. To do that, new strategies should be developed in order to foster the cross-scaling, following the local pilot applications. By analyzing the two case studies presented in this paper, we discuss how to overcome the threshold that turns a project from being only applied in a pilot case to be an open tool for anyone, anywhere in the world, aiming at in the end becoming a *glocal* solution. With the approach presented in the paper, the suggestion for designers of complex systems is to have a well-planned after-project phase in order to achieve a *glocal* exchange of knowledge and therefore a resilient network for an efficient scaling-up.

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# Becoming the catalyst for an Open Innovation Ecosystem by Design. Design Thinking as cultural enabler for digital transformation at 'Energias de Portugal (edp)'



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## Abstract

The exponentially rapid change in technology (Brynjolfsson, E. & McAfee, 2014, adapted by KPMG 2016) and its infusion to every aspect of businesses as well as the shift to renewables challenges the energy sector, initially designed to pursue mainly exploitation activities in a stable, predictable environment. This article shows how Design Thinking infused in a pilot project could set the ground for the digital transformation and the emergence of an open innovation ecosystem. Electricidade de Portugal (EDP) is a globally leading company in the energy sector who has successfully pursued exploitation activities (generation, transport, distribution, supply and gas commercialization) for the past 40 years. Collaboration and agility attributed to exploration activities became relevant to stay competitive in a changing industry. However, the adoption of a new IT system in 2016 did not lead to the desired outcomes in setting the ground for a culture of collaboration. A human-centered approach through Design Thinking (DT) and Design Research methods helped the company detect the needs and pain-points of its employees, who subsequently co-created the solutions for a digital workspace with the implementers in iterative cycles. As the qualitative longitudinal case study reveals, the design intervention led to a viral, ongoing infusion across all departments of routine-changing DT methods and a postmodern architectural workspace (coworkingspace). Ultimately the emergence of a new self-understanding of the company as an open innovation (Chesborough et al. 2006) catalyst in the changing energy sector was established. Design Thinking (DT) is fast becoming a key instrument for generating innovative ideas in the exploratory phase of innovation (Liedtka, 2017; Brown, 2008; Dorst 2011). While large companies are in desperate need for change they have the tendency to commodify innovative post-rational practices such as Agile (Medinilla, 2012), Lean Startup (Ries, 2011) or Design Thinking, expecting quicker wins by leap-frogging steps. By doing this, they attract subsequent problems such as idea-cemeteries, networks of 'strangers to the system' and talent-loss that only become obvious during exploitation activities like production and distribution (Marzavan & Augsten, 2016). Meanwhile DT could address these consequences if being implemented as a strategic art and social practice for organizational change. This case sheds light on prerequisite conditions

(practices in place) necessary for an emergent strategy of digital transformation and how these conditions impact culture, structure, and people's mindset hereby increasing the innovation adaptive capacity of large organizations. Here DT was introduced as a strategic art. According to Junginger's triad (2016), Design is a technique, method and a strategic art. Junginger (2016) claims that a 'technique' solves isolated problems and is characterized by 'excellence of making' similar to engineering. Furthermore a 'method' is an intellectual or scientific framework, which brings specialized knowledge into practical use. However, only if design is applied as a 'strategic art' does it provide principles and strategic guidelines to utilize methods and techniques for organizational change. Following her argumentation and combining her model with the model of social practice and strategy as practice (Reckwitz 2006, Jarzabkowski 2004) this paper reflects on the application of DT as a strategic and adaptive social practice at EDP. The sample includes 200 hours of participatory observation, 12 cultural probes, 15 qualitative interviews between during two years with key stakeholders and top managers. The findings formulate practical advice on (1) how to implement DT for business innovation at its full potential and (2) how to infuse innovation as strategic social practice. As empirical research by Beckman and Whalen (2019) points out, changes triggered by digitalization through Design Thinking can initiate a digital transformation that transcends the provided structures for innovation. The implication of these findings for academic research include the discussion of a new model for describing Design Thinking and design activities aimed at organisational change with a social practice vocabulary that allows for 'organizing' (Chia, Mackay, 2007) to be managed. The theoretical implications of infusing DT as a social practice in large organizations challenge the way we will manage tomorrow's organizations.

**Keywords:**

**Design thinking, open innovation, ambidexterity, social practice**



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# A Framework of Service Design Knowledge

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## Abstract

### AIM

Service design is a growing research interest to many disciplines. As it is researched by various disciplines beyond design community, the difference in their theoretical roots and methodological traditions, service design encompasses multiple disciplinary perspectives. In design, the scholars investigated the role of design in the service sector mainly from a design management perspective to explore service sector as a new territory in early 1990s. Now, although its definition is still contested, many have agreed that service design entails a human-centred, holistic, creative, and iterative approach to creating new service futures (Meroni & Sangiorgi, 2011). There is a call in research to develop a more inclusive view about service design that synchronizes with other disciplines and discourses. For example, (Bitner et al. 2015) examine the links between service design and innovation to develop an agenda to strengthen the research impact (Junginger, 2015) shows how service designers may engage organizations in high-level transformational thinking around their own design activities, by introducing the concept of organizational design legacies. The need to embrace different perspectives is well recognised in literature, however, a more systemic approach is needed to understand whether there is a cohesive framework that the knowledge about service design can be grounded that overcomes the differences between disciplines; and what are the common grounds that these disciplines collectively contribute to the development of service design. Although the publications on service design have grown significantly since in recent years (Sun, 2019) our knowledge about how service design is perceived collaboratively by these multiple disciplinary perspectives is lacking. The study initiates a systemic inquiry into the academic publications on service design. It analyses knowledge embedded in the academic publications about service design, in order to contribute to our epistemological understanding of this subject and its theoretical development as a discipline. This study used a summative content analysis approach to analyse a total of 219 academic publications with service design as a primary research subject. Summative content analysis involves counting and comparisons, usually of keywords or content, followed by the interpretation of the underlying context (Hsieh & Shannon, 2005). The goal is to provide knowledge and understanding of the phenomenon under study. In this study, academic publication on service design was the phenomena under investigation. The sample publications were retrieved from a UK University's library online resource that covers a wide range of databases. The search period was from 1990 (when service design first appeared in this online resource) to September 2019 when the study took place. A summative analysis process was followed.

#### KEY FINDINGS

The findings confirm that research into service design encompasses multiple disciplinary perspectives, whilst, a large percentage of sample papers are published in design journals. The analysis has further revealed a framework that service design knowledge can be grouped into the four areas. The top mentions of keywords were shown in each area.

#### CONCLUSIONS

Research into service design is fragmented. The study initiates the attempt to develop a coherent framework of knowledge to outlines the dimensions that service design knowledge could embrace. Future research is needed to further populate the framework.

#### Keywords:

**Service Design, Design Research**

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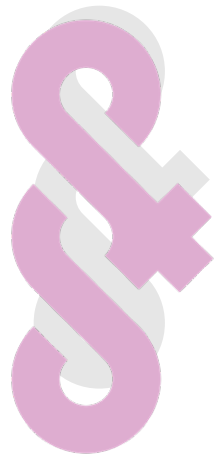
# Design for Equality: an introductory perspective for IADE case study

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## Abstract

Even if gender equality indicators have significantly improved in education, discrepancies in different professional areas are still being documented by researchers and organizations. Nevertheless, the components of equality and diversity have turned into a reputational asset for governments, businesses and markets, thus raising the importance of bringing gender issues into the training of students that will form the future workforce. Encompassing problem-solving techniques, and through a holistic approach, Design can be a useful answer for creative industries to empathically deal with gender issues. Through a case study conducted at IADE Creative University, this project aims to set a strategic framework to respond to a declaration on gender equality signed by the university. An assessment over the panorama of gender equality in this type of environment was conducted to support the project. As observed, regardless of legal and voluntary measures already taken by the university board more than punctual solutions are needed to ensure an egalitarian development for women. The first phase of this research highlights the importance of high education institutions in long-term commitment to create a significant impact along women's life journey. Thus, it elevates the role of Universities in gender equality namely to develop strategic solutions that can promote relevant transformations in personal, social, and market layers.

## Keywords:

**Gender Equality, Design, Strategy, Universities**

## 1. INTRODUCTION

Gender equality is no longer confined to the social dimension and represents an asset within the economy and businesses. It turned to be a strategic tool for companies dealing with innovation and the promotion of a more egalitarian workplace turned, also, into a challenge for most of them (PWC, 2015). In this context it is indispensable to understand the baselines from which universities address these issues. Compared to men, women do not have equal access to creative work, are not equally rewarded and are subject to diverse forms of occupational segregation, that reinforce inequalities, while hegemonic masculinities continue to be reproduced (Sang et al., 2014 at Finkel, R., 2017). It is important to highlight that gender intersections of class, race/ethnicity, age, disability and sexuality, also affect those disparities boosting the lack of access and opportunities by segregations defined from cultural and societal behaviours (Grugulis and Stoyanova, 2012 at Finkel, R., 2017). The perpetuation of these inequalities can be seen in Portuguese universities, for instance, in cases related to “praxes”, a common academic ritual often associated to entry into the university, as reported by Oliveira, Villas-Boas & Las Heras (2016), in which social and cultural gender biases and discriminations are perpetuated. Surprisingly, few studies addressing the issues of gender equality appear to have focused its observations in universities, which form and prepare professionals for the creative industry. The effect of this gender disparities is seen in social and economic fields but also in technology and product and services design (Perez, 2019). As observed by Perez (2019), the ‘absent presence’ of women it’s a gap of data and also a reflection of a human default of ‘gender neutral’ ideal, that impact women’s life when creates human-

computer interactions paved by bias, or define heroes in games as male, or develop a mobility bus system without taking into account the care-related travels made by women. The scenario suggests that part of the educational role should take place inside the university, in order to prepare graduates to grasp equality principles to better respond to society. This research looks forward to extending the knowledge into the role of universities in the development of the workforce and, particularly, to understand their contribution in promoting an egalitarian and diverse role for women (Tauke & Bitterman, 2004). As a preliminary work, this article is the basis to develop solutions using Design to address the issues detected in the case study.

### IS THIS A MAN’S WORLD?

The participation of women in society evolved during the last century. Today, in the European Union (EU), there are 5% more women than men in the total population and women already represent 58% of graduated students (Eurostat, 2015). A quick overview into history shows, nonetheless, that it was not always like this. As stated by Silvia Federici (2013), the deconstruction of the role of women in society was mostly related to their role as an agent of capital transformation, where female actors had their power and participation subdued. Women were reduced to the function of reproduction, as stated in Karl Marx’s primitive accumulation principle, in order to increase the working force numbers and allow for an expansion of the capital (Federici, 2013).

During the first half of the 20th century, the world wars came to an end and women have continued steadily, with their own battles, maintaining and strengthening their presence to a wider and more



decisive role in society. Some experts consider that we are now living a third feminist revolution (Johnson, T. B., 2017). “Waves of feminism” are perceived to take place when women increase the fight for rights, from Suffragists, to the women’s libbers in the 1960’s and to nowadays defendants of an egalitarian position in society (Johnson, T. B., 2017). April Sizemore-Barber rejects this idea, by saying: “I don’t think we are in a wave right now. I think that now feminism is inherently intersectional feminism — we are in a place of multiple feminisms” (Velez, Sizemore-Barber & Chan, 2018). By its nature, third-wave feminism is plural and focused on individual identity, crossing the borders of ethnicity, nationality, religion and culture, to incorporate new elements, such as womanism, girl power, post-colonial (anti-imperialism) theory, postmodernism, transnationalism, cyber feminism, ecofeminism, individualist feminism, new feminist theory, transgender politics or the simple rejection of the gender binary (Fisher, 2013).

Despite differences in economic and social indicators, equality and diversity issues are not restricted to developed or developing countries. What appears to be, as observed Simone de Beauvoir in 1949 and widely illustrated by Perez (2019), is that men commonly confuse their own point of view defining humanity as male and seen women as a non-autonomous being. The lack of access of data and the neutrality in gender makes what the author defines in its book as the story of Invisible Women, the biggest impact on women’s life in address solutions to our society, which just be closed when female representation will be relevant (Perez, 2019).

However, even with a large work and compromise to create policies to correct the gender gaps, according to recent data the gap will just be filled in 200 years (World Economic Forum Report, 2018). In the EU the latest strategy sets an increase of 75% in women and men’s equality and work opportunities, for workers from 20

to 64 years old, thus giving more possibilities to reduce barriers to women’s participation in the market (World Economic Forum Report, 2017). This is the reason why this paperwork reinforces the role of education. If, in one hand, women represent a majority in certain domains of the market, society and universities, on the other, earning and organizational disparities and patriarchal stereotypes still prevail (Casaca, 2014; Torres, 2015). Equality is a long road to be driven by those who believe that gender, colour, race or beliefs do not define the potential from an individual worker.

#### **WHEN DESIGN EMBRACES GENDER**

The creative industry is historically marked by female exclusion, as noted by Buckley (1986), who found that in Design methods of selection and classification were largely influenced by a patriarchal and capitalist context, which tended to favour, among others, mass production to the detriment of artisanal skills. However, women have been involved with design in a variety of ways, but both past and present are consistently ignored (Regina, & Correia, 2016; Souto, 2018). Designer Oliver Lindenberg defends that the industry is responsible to promote balance and foster new talents and contributors, with a representative gender ratio (Lindenberg, 2014). In the industry of design, Caucasians (60.4%) and women (53.5%) represent relative majorities (Design Census, 2017). But race/ethnic diversity are part of the picture in the creative field, too, entailing different experiences, perspectives and approaches. In this context, organizations and companies have been creating ways to empower women and alleviate gaps. Even with some initiatives and results, the lack of diversity promotion is amplified when addressed in terms of race and cultural references (Bohnet, 2016). An inefficient access stands out particularly for those who come from marginalized groups, such

as black people, Latin Americans or refugees (Walker, 2017). To understand the difficulties for design to embrace diversity, we must look into its historic, cultural and economic approaches. From European Modernism, throughout the 20th century, to the Economy of Scale, Design changed its behaviour to embrace the benefits of standardization and to reflect cultural diversity from the viewpoint of the market's needs (Inglehart & Norris, 2003). Nowadays, the discussion around the human component that develops design and influences professionals in the area is more concerned in aligning the diversity component in order to represent the multicultural global overview (Rawsthorn, 2011). Coming back to the present, in 2017, Google shared an internal memo against gender diversity, arguing that gender disparities at the tech giant could be explained through biological differences (Revesz, 2017). In November 2018, women took the streets to protest over claims of sexual harassment, gender inequality and racism taking place at Google (Revesz, 2017). These events show us that procedures and policies to ensure equality and fair access for women in work are still needed. Workplace life demands well-prepared teams to conduct the gender balance inside companies, from bottom to top leadership. Companies are ought to invest resources to overcome problems stemming from the unconscious bias. Even when we do not intent to categorize, when we learn about the sex of a person, gender biases are automatically activated (Bohnet, 2016). The unconscious bias is almost everywhere, and more difficult to fight, and it is known how it impacts companies' businesses (Bohnet, 2016). Identifying stereotypes helps people to understand and process information about culture and values and to realize how behavioural processes happen. Some companies have addressed the problem by creating specific departments, applying de-biasing techniques, creating practices and promoting diversity

training among the workforce. But results are fragile in evidence concerning its effectiveness in overcoming the unconscious bias.

Some universities have created a Chief Diversity Office (CDO), a high-profile employee charged to promote diversity at the highest levels of governance. However, after analysing more than 4.000 students, from 2001 to 2016, Bradley, Garven, Law & West (2018), did not identify a significant effect of this position in the academic community. When many different approaches do not work, a good approach is to step back and think about the role of universities in the development of egalitarianism at the workplace and in businesses. After all, the university prepares people to face the market, so one can suggest that the university should be the place to confront the unconscious bias and to design behavioural approaches that work better inside companies, for a more egalitarian approach in society and business.

## METHODOLOGY

This methodology focused on understanding the current context of gender equality issues, as well as understanding the particular reality of this institution, and, more broadly, raising potential issues of approach to be asked through strategic design. It intends to provide a strategic baseline to address a declaration on gender equality that was signed before by the university that was the target of this study. By taking into account the current context, the knowledge and perceptions of students, and the experience of a women's life in their journey through adulthood, this paper provides the baselines to understand and, in the future, amplify the universities role to address gender equality. The research consisted of five distinct stages, namely : (i) a literary review on the proposed topics, to provide context and preliminary analysis, (ii) data collection on gender

issues, through a questionnaire conducted at the university of the case study, (iii) analysis of the collected data, mapping of gender inequalities and identification of the current situation at the university, (iv) application of design tools, to construct an ideal model for a real practice of gender equality at the university, and (v) recommendations of strategic solutions and applications to develop design equality at the analysed university.

According the World Economic Forum (2017) and the United Nations Sustainable Goals, the education and professional developments are essential to achieve gains in life, but women tend to face inequalities in work opportunities, stereotyped professions, discrepancies in salaries and many other challenges that are undesirable for a positive performance in

gender equality. Thus, the future of this research takes into account all the inequalities faced by women during their life journey (Torres, 2018) to encompass challenges and opportunities where high education institutions can actively act to improve women's life. So, the next step of this research will be based on a design journey model created by Walker (2017) and will invite professionals and students to participate collaboratively, where this approach will be explored in a future paper.

For data collection in the second stage, the questionnaire considered Leymann's Inventory of Psychological Terror (LIPT) (Leymann, 1990). A questionnaire was presented to the students of different courses from IADE-Lisboa, during the 2017/2018 and 2018/2019 academic periods.

Course Designation	2018_2019		2017_2018	
	Women	Men	Women	Men
Phd in Design DES	19	18	17	16
Master in Branding and Fashion Design	63	6	44	2
Bachelor in Design	434	219	433	242
Bachelor in Photography and Visual Culture	75	38	71	47
Bachelor in Marketing and Advertising	491	287	435	257
Bachelor in Global Design	72	33	51	25
Master in Design and Visual Culture	83	43	75	35
Master in Design Interaction	13	15	7	8
Master in Product Design and Space	17	10	13	12
Master in Design Management	32	17	19	11
Master in Design and Advertising	59	14	49	15
Master in Marketing	2	1	14	4

Table 1: Total number of students per course in the 2017/2018 and 2018/2019 academic periods.

46 students randomly selected from graduation and master classes participated in the first part of the qualitative research. At a first glance into data, the university did not appear to show huge inequalities for women in what regards their representativeness; the university had a high representation of women (65,6% of women compared to 34,4% of men) and the board of teachers was set on a 50%/50% basis. Nevertheless, the questionnaire showed how relevant and necessary is the subject. More than 50% of students reported not to have heard about gender equality being discussed inside IADE, notwithstanding the fact that 67,4% of them considered it to represent a topic of interest. Besides that, 45,7% of respondents considered the issue of gender equality to be a matter of concern for all, while 34,8% directly pointed out to the responsibility of the university to address the topic to contribute to an egalitarian market. Another point that causes attention was the fact that in spite of a seemingly balanced environment, 67% of the inquired students noted that they had suffered cases of moral abuse. Situations of harassment were reported to have been personally experienced and/or identified in the campus, mostly through sexist jokes and anecdotes (43,8%), constant interruptions while another person was speaking (12,5%) and defamation about physical appearance (9,4%) - with these accounts being almost exclusively delivered by female respondents. To deepen the understanding of the reality and perceptions of gender issues on the side of the market and workforce, interviews were used to collect information for the research. A total of four interviews were made with university teachers and professionals working in Portugal that, in the framework of their duties and responsibilities, were frequently confronted with gender issues. An unstructured or non-directive interview model was selected to stimulate ideas and free thinking from the respondents. The

interviews highlighted all the aspects of inequality and stereotypes experienced by the interviewees throughout their professional lives.

An overview of literature shows the economic and social relevance of gender equality, a complexity reinforced in the interviews made by professionals. However, some of the most relevant information collected in this research comes from the intersection of the collected data, which helps to highlight how the different stages of a women's life are plagued by inequalities. This should encourage to think about the role of universities in promoting gender equality and to realize that the answer to ensure a comprehensive frame should be done through a more accurate and holistic approach. Taking into account the complex nature of gender equality issues and how disparities appear throughout women's lives, the role of Design must be to drive a more enlarged view of measures taken and to bring in all participants of the educational system, i.e. the university board, students, teachers, staff, but also society and partners from the public and private sectors.

Part of this research is set on design techniques and tools. A design journey (Walker, 2017) applied to the fourth stage of this research will help to better understand the barriers and opportunities felt by professionals and students in creative industries. The collected data will support mapping and identification of practices and behaviors to be worked out. The results and ideas generated through the process will feed the strategic work for the last stage. The sessions will be conducted taking in account the relevance of the participants in the creative industry in Lisbon, the stage of life and the area. The intention is to have mixed profiles that can better enable to see the barriers in every stage of life.

## ACKNOWLEDGEMENTS

The social behaviour and the entire market are turning to a more participative and egalitarian approach, what calls for a generation that is capable to integrate and amplify the perception about what consumers need. Furthermore, for an egalitarian development in the public and private sphere, it is urgent that stereotyped and micro-abusive behaviors become less prevalent. These are times where cooperation and empathy are required, and the role of universities should be to help students develop such qualities, by reprogramming cultural behaviours perpetuated for centuries. To address solutions for gender equality at university, one must consider the effects of this issue in the life journey. Due the complex structures surrounding gender issues, this could be possible if, inside academia, students are in touch with an egalitarian environment, if submitted to a debate on equality through theory and practice, and/or if given the same opportunities to reach their goals, in a cross-sectional and intersectional way. Time is opportune to think about the role of the university in forming individuals that will compound the next workforce and to help not to perpetuate stereotypes and behaviours of unconscious biases. Being the creative industry an area that processes the needs and behaviours of societies, it is urgent that, as professionals, students and social agents, we develop work solutions that resonate with a broader population, and that contain meaning for broader audiences. After all, Design is about helping people make better decisions by experience and creating a proposal to help students and the labour market to be more adaptable to these changes. There is a potential in this research to develop strategies and solutions that are practical, after a deep analysis and experience developed with all components that form part of the academic

reality. By using Design as a complete component, we are able to get in touch with discoveries that will help us to define new fields of action. For this reason, this article is a starting point to shed the light on the issue. This preliminary article is aimed to design the next steps of what intends to be a more detailed study applied to this theme, seeking to build a solid proposal even.

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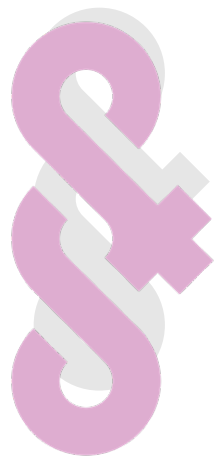
# Museum Accessibility: a discussion about mobility and environmental interaction for visually impaired visitors

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## Abstract

Navigating the museum can be challenging for visually impaired visitors, and it is even more challenging to locate the exhibits on display and to interact with the environment and with other visitors. People who have visual impairments exceed 2 billion individuals worldwide (WHO, 2019), and they may represent an essential cohort of museum visitors if they are welcomed and included in these spaces. Museums and cultural venues represent an excellent opportunity to test and implement social inclusion strategies that can later be applied to other places.

The study described in this paper is part of ongoing research that intends to analyze the experience of visitors with visual impairment in museums and understand the relationship and interaction between the visually impaired visitor and the built space of the exhibition. This paper presents the results of the first step of the research, which comprises an exploratory literature scan. The goal of this scan is to investigate the current state of accessibility of museums in Brazil, especially for visually impaired people.

## Keywords:

**Museums, disability, accessibility, visual impairment.**

## INTRODUCTION

Every human being has the right to access culture, which is guaranteed by the Universal Declaration of Human Rights of 1948. The declaration states that Everyone has the right to freely participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits (UN, 1948). Therefore, all individuals, regardless of their physical or psychological characteristics, diseases, or any other socioeconomic factor, have the right to enjoy culture (Sarraf, 2018).

In order to ensure that these rights are respected, public spaces that include different types of cultural production such as exhibitions and the other cultural projects should promote a set of adjustments, measures, and attitudes that provide equal opportunity for all, especially for the public with disabilities, as they are the ones that demand the most changes in spaces, services and cultural products (Sarraf, 2018).

Museums are not only institutions for collection, preservation, and exhibition of objects, but also have a social and educational role as they represent a space of non-formal education. These areas may represent a significant opportunity to test and implement accessibility and inclusion projects and strategies that can be replicated in other places.

As stated by the World Report on Disability published by the World Health Organization (WHO) in 2011, disability is not restricted to a specific portion of the population. Moreover, it is seen as an inherent part of the human condition. Almost all human beings will have a temporary or permanent disability at some point in life, and those who survive to old age will experience increasing difficulties in functioning (WHO, 2011). Disability is a result of the interaction among people with impairments and barriers - behavioral and environmental. Once these barriers are

hindering disabled people from participating in full and effectively in an equal society. This interaction reinforces the collective responsibility on the respect for human rights, in order to build a more equalitarian society and to question stigma and prejudice that can prevent the promotion of social inclusion (Santos, 2011). The study described in this paper is part of ongoing research that intends to analyze the experience of visitors with visual impairment in museums and understand the relationship and interaction between the visually impaired visitor and the built space of the exhibition environment. This paper presents the results of the first step of the research, which comprises an exploratory literature scan. The goal of this scan is to investigate the current state of accessibility of museums in Brazil, especially for visually impaired people. The investigation comprehends the study of exhibit space, the relationship between the museum environment and mobility, and how these elements affect the experience of these visitors.

## ACCESSIBILITY FOR VISUALLY IMPAIRED VISITORS

According to ICOM – International Council of Museums – “A museum is a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for education, study and enjoyment.” (ICOM, 2007). Thus, museums act as spaces of enjoyment, knowledge, self-knowledge, and affirmation of the sociocultural identity of its visitors (Lima; Berquó, 2011).

The museum is a dynamic institution, and its role and the public and governmental understanding of it have changed radically in recent years. As stated by ICOM, many museums are recognized as having a profound effect locally, nationally and internationally – they contribute to the reputation and standing of a city or country, they are places of discussion and debate on pressing challenges of identity and democracy and are leading institutions of civil society and active citizenship. They have critical educational effects and a vital role to play in breaking down social divisions. They are significant contributors to local and national economies and communal well-being (ICOM, 2016).

Brazil has over 45 million people with some form of disability, which corresponds to 23.9% of the total population. Among the impairments, visual impairment has the highest occurrence, affecting 18.6% of the population (SDH-PR; SNPD, 2012). Visual impairment is the loss or reduction of the functional visual capacity in both eyes, without the possibility to recover it through the use of lenses or medical treatment and surgery, and may vary concerning their causes (trauma, disease, malformation, poor nutrition) and nature (congenital, acquired) and results in a reduction or loss of ability to perform visual tasks (Mesquita, 2011).

Even more critical than the anthropometrical differences and characteristics that might determine specific needs among the different groups of impaired people are the social, economic, and cultural aspects. They affect not only environmental accessibility, but also the legislation and regulations concerning accessibility rights. They are the origin of the problem, thereby affecting the number of people afflicted, the forms of disability, and the social and age groups. In Brazil, the situation of the visually impaired varies from state to state, according to social and economic aspects. As in other countries, most people with visual impairments are those with

low vision or partial vision, rather than the blind (around 10% of the visually impaired are blind) (DISCHINGER, 2000).

For blind people, more than for people with low or partial vision, touch is the primary perceptual modality used to interact with the objects, surfaces, and environments. Cooperation between the sense of touch and the kinesthetic sense is called haptic perception. Nunes and Lomônaco (2010) point out that the use of haptic references and other senses is not a mere compensation of the lack of visual references, but a biopsychosocial reorganization that allows access and processing of information. However, this ability is often ignored by common sense, and it is believed that the spatial perception depends on vision and that without it, people are not able to orient themselves in space (Vigata, 2016). As stated by Amiralian (1997), it is through language and kinesthetic and tactile perceptions that visually impaired people achieve their cognitive development. This idea shows that without vision, the perception of reality is different, but not necessarily better or worse. As pointed out by Nunes and Lomônaco (2010), this means that the experience of visual impairment is not the same as someone blindfolded. The perception of the world, especially for the blind, is made in a significantly different way, and the person only perceives disability through social interactions that show them that they are different.

The presence of visual stimuli is predominant in people's everyday lives and comprehends a vast and significant information repository. As a consequence of this visual society, exhibitions and cultural mediation strategies still exploit excessively the vision, leaving aside all the richness of interactions that can occur in projects that are more accessible and inclusive (Sarraf, 2018).

The adjustments resulting from accessibility practices benefit not only the people with

disabilities but the whole community. As an example, by replacing stairs for ramps, the space becomes accessible not only to people in wheelchairs but also facilitates the mobility of elderly or people with impairments and even adults with strollers or shopping carts (Sarraf, 2018).

## EXHIBITION DESIGN AND THE MUSEUM EXPERIENCE

The visitor's experience inside the exhibition space is related to the individual's perception of this environment and is connected with other perceptions experienced by them before. According to Cury (2005a), the experience is a result of a process of interpretation and communication that takes place space. It can be presented at different levels: between the individual and object, between the individual and the built environment, and among different individuals present in space.

The environmental perception that visitors have of an exhibition is defined, among other factors, by the internal organization of the exhibition space (Costa, 2014). Architecture affects how the museum is experienced, as it is possible to design the exploration and navigation of space according to the relationship among rooms, galleries, and other environments (Tzortzi, 2011).

The way the visitor navigates the space is what determines what they experience and apprehend of the exhibition. Bitgood (2013) emphasizes the need to design space navigation systems that are efficient in capturing the visitor's attention so that their movement in this space generates a minimum effort and keeps them engaged with the exhibition. Therefore, if the environment presents itself in a confused way, without providing specific clues of the path to go through, this can cause a decrease in the level of visitor engagement and attention, which can generate disinterest and

fatigue (Medeiros, 2017).

The exhibition route is formed by several signs that can contribute to the visitor's mental map of the exhibition. This achievement would represent the union of the universe that already exists in the visitor's mind - before entering the museum - and the repertoire acquired during the exhibition. That is the construction of a new repertoire of new values and knowledge (FIGUEIREDO-LANZ, 2016). The visitor appropriates the space, thus creating their route, even if the path is predefined. In this appropriation, the body is the starting point for the sensory perception of the environment (Cury, 2005b).

## MOBILITY AND ENVIRONMENTAL INTERACTION IN THE EXHIBITION SPACE

The design of the built environment is still very focused on the sense of vision, which makes the process of elaborating a proper mental route for people with visual impairments difficult due to inexistent or insufficient reference marks in a given space. A proper route should be one that allows them to have autonomy and resourcefulness in the interaction with the environment (Santos; Costa, 2015).

Passini (1996) states that the difficulties imposed by physical-spatial structures expose people to frustrations, stress, and loss of time, in addition to feelings of dependence and inability to perform activities independently. These difficulties can be avoided or mitigated, during the design project, by taking into account the way people with visual impairments navigate the space. Spatial orientation, according to Felipe & Felipe (1997), is defined as the ability of an individual to perceive the environment, establishing bodily, spatial, and temporal relations with it.

Spatial orientation is not only influenced by the

sensory experiences of each individual but also depends on the ability of the space in offering the necessary information (Bins Ely, 2004). Spatial orientation projects for visually impaired people require a detailed analysis of the space, identifying potential information that allows the location and identification of activities, routes, references, as well as the understanding of spatial relationships and museum narratives (Bins Ely; Dischinger, 2010).

According to Castro et al. (2004), orientation is one of the most crucial autonomy aspects to be considered, especially by those who have visual restrictions. Visually impaired people perceive spaces through different sensory mechanisms and strategies (Santos & Costa, 2015).

To improve mobility and environmental accessibility for the visually impaired means to improve their possibilities of perception, understanding, and the effective use of space. It means, in the first place, being able to know what can be approached. Secondly, being able to know how to get there, and finally, how to use it. The absence, or reduction of visual information, in the case of the visually impaired, means that orientation and mobility are compromised. Consequently, improving accessibility for this group of people requires the investigation of spatial orientation and locomotion, as well as the specific interface design of particular urban furniture and equipment (Dischinger, 2000). The tactile sense (textures when stepping, walls, handrails, drafts, solar radiation), sounds (traffic, voices, birds, wind, steps, echo), odors (traffic, garbage, perfumes, food, plants), all contain a rich, but generally ignored palette of impulses for a sensory experience (Froyen, 2006 apud Brandão, 2011, p.27).

Multisensorial projects can be challenging and complex, but they are essential for integral accessibility. The participation of people with disabilities in accessibility projects enables dialogue and knowledge of the needs and desires

of these individuals (SARRAF, 2018).

## PARTIAL RESULTS AND NEXT STEPS

The research described in this paper consists of three phases: a literature scan, field studies, and user interviews, and accompanied walks.

An exploratory literature scan was applied to gain a better insight into the context of museum accessibility and how museums in other cities are dealing with the same issues. The scan addresses topics such as:

- Disabilities and Visual Impairment
- Accessibility and Social inclusion
- Universal Design and Participatory Design
- Museums and Assistive Technology

Field studies consist of exploratory visits to selected museums. The exploratory visit can assist in the analysis of the built environment functionalities (Ornstein, 1992).

A field study is currently being conducted, and it aims to investigate the accessibility resources used by museums in Rio de Janeiro state, where the number of visually impaired exceeds 6 million individuals (SDH-PR, 2012). The idea is to highlight how museologists and designers are addressing the mobility and environmental interaction issues faced by visually impaired visitors.

The next steps of this study include interviews and 'accompanied walks' with visually impaired visitors to assess their experience in the selected exhibit. 'Accompanied walks' are based on the observation of individual actions in attaining desired activities, i.e., orienting successfully along a route. Instead of using direct questions, visitors are encouraged to verbalize their actions and spatial strategies. The researcher should not assist or lead the respondent and may interfere only in situations that present risks to those involved (Dischinger, 2000).

The use of the accompanied tour will be essential to understand how visitors with visual impairment interact with the museum environment, how they perceive the narrative of the exhibition as they navigate the route proposed by the museum.

This ongoing research aims to support the promotion of social inclusion of people with visual impairments

in museums and cultural spaces and further instigate the discussion on accessibility and universal design studies.

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# How to design for taboos?

## A design intervention to overcome the taboo of menstruation in India

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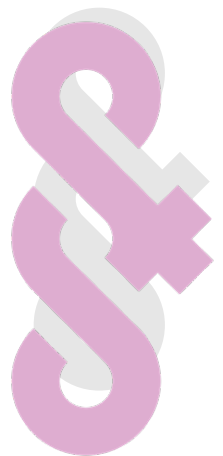
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### Abstract

Taboos are like “open public secrets” and often dealing with these topics can be challenging due to the negative societal view. However, taboos can have a strong impact on the well-being of people, therefore, addressing these subjects is of high importance. In this paper seven building blocks to design for taboos are presented. These blocks were identified during our desk and field research project on the taboo of menstruation in India. Menstruation is a taboo that is prevalent worldwide, but in the low and middle income countries such as India, it has an even stronger negative impact on the lives of women. It is a subject that women deal with in secrecy and shame, often without involving men into the subject. However, India is a patriarchal country where men have a direct impact on the lives of women and the way women conduct their periods. Though efforts do exist to deal with the issue of menstruation, none so far have a focus on the stigma and shame that prevent from dealing with the subject openly. This paper presents the approach of gamification and humor in order to create a positive atmosphere for a discussion on the topic of menstruation inside the family house with all family members as a first step towards dealing with the subject.

### Keywords:

design for well-being, taboo, menstruation, India, humor, gamification



## INTRODUCTION

Discussion about taboos bring strong discomfort as these subjects hold negative views and disapprovals. However, many stigmatized and taboo topics are related to global issues such as homelessness, epidemics, sexuality (Kisch, 2019), therefore addressing these issues is of paramount importance as they influence the quality of life by keeping certain aspects in the dark (Fields, Sinclair & Valdes, 2010).

Design can play an active role in mitigating the taboos. However, it does require a careful approach as taboos are sensitive subjects and if addressed wrong can create a strong opposition and suspicion (Weiss-Wolf, 2017). This paper presents building blocks to design for taboos which have been defined in our research project and illustrates our case on taboo of menstruation in India.

There are 7 building blocks defined: 1. Define the problem, 2. Understand the context, 3. Find the loophole, 4. Set the mood, 5. Bringing everyone on board, 6. Create a culture – fit, 7. Test ,iterate, test, iterate.

### BUILDING BLOCK 1: DEFINE THE PROBLEM

In most of the world, menstruation is not an openly discussed topic (Thakur et al., 2014 ), yet it affects half of the world's population. The focus of our research project was the context of India. Menstruation has numerous negative connotations in India, but the most common one is that it is seen as unclean or dirty (Omidvar & Begum, 2011). The taboo of menstruation has a strong negative impact on the lives of Indian women, such as on their education, employment, health, religion, relationships and overall well-being (figure 1). In India, the situation of menstruation for women depends on the location and the local existing menstrual practices (Kishor

& Gupta, 2009). These practices can vary from a slight change to their daily routine such as usage of different clothing, changes to hygienic routine, to stronger ones, such as avoiding physical contact with others, exclusion from religious prayers or even isolation. According to a 2016 analysis conducted by the Tata Institute of Social Sciences (TISS), only one in eight girls surveyed faced no restrictions during their periods (Eijk, Sivakami, Thakkar, et al., 2016). Most important finding of our research was the impact of men on the way women conduct and view their menstruation. It has been shown how a positive outlook of men on the nature of menstruation influences women to have a positive view themselves. This relation has been taken as our focus of action.

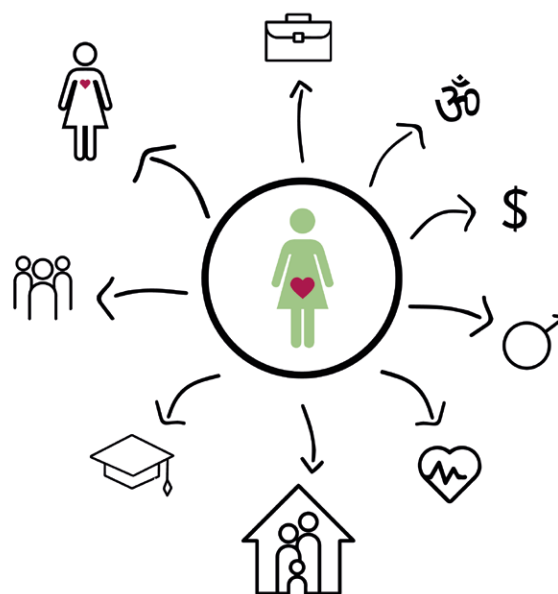


Figure 1. Different aspects in the life of a woman in India affected by menstruation (work, religion, financial issues, relationship with men, health, family, education, society, personal issues); (Own ill., 2018.)

## **BUILDING BLOCK 2: UNDERSTAND THE CONTEXT (AND ALL OF IT)**

In order to understand the current position of the taboo one must investigate the origin of it. When working for a context and culture outside of one's own, this also includes understanding the society, its structure, history, values and interpersonal relations as these aspects shape the behaviour towards the subject.

Such a negative image of menstruation in India has been created in the society for centuries through various influences - religions, myths created through the lack of knowledge and fear, as well as rigid traditional upbringing. Based on the insights gathered from the research we conducted in India, 7 constraints were identified that have an impact on the current image of menstruation in India. The constraints also show the impact menstruation has on the lives of women and how the taboo positions women within the Indian society. These constraints are described briefly below.

### **1. MISCONCEPTIONS OF THE VEDAS**

The old Vedic scriptures not only hold essence in protecting women, but they celebrate menstruation as a sacred time. These practices have been distorted through the years by mechanically following without understanding the meaning behind them, and today they hold strong negative connotation (Sridhar, 2016).

### **2. TABOOS AND MYTHS**

There are many practices that women in India follow during their periods that have been passed on from generation to generation. The practices vary through families and regions, and can vary from small iterations to daily routine (such as not entering the kitchen, exclusion from religious practices) to life threatening poor conditions such

as the ones of menstrual huts (FSG, 2016).

### **3. POOR MENSTRUAL HYGIENE**

Women's health in India is exposed to many risks due to various aspects like unsafe usage of menstrual products, lack of facilities, lack of education, bad sanitation, but also due to the beliefs and shame connected to menstruation that prevents women to address the issues in time (Majumdar, 2014).

### **4. LACK OF EDUCATION**

Cultural taboos can restrict youngsters from learning on topics of critical importance (Sorcar, Strauber, Loyalka, Kumar & Goldman, 2017). A range of studies have shown that about 70% of girls have no knowledge of menstruation prior to their menarche (Misra, Upadhyay, Sharma, Krishnan & Gupta, 2013), causing their first experience of a period to often be a traumatic one. A majority of them (62%) were unaware of the reason(s) for menstruation, (Misra et al., 2013), or had wrong information (Juyal, Kandapal, Semwal & Negi, 2012).

### **5. GENDER INEQUALITY AND PATRIARCHY**

India ranks 130th out of 155 countries in the Gender Inequality Index (GII), trailing behind lesser developed Asian countries such as Bangladesh and Pakistan (Kishor & Gupta, 2009). The gender inequality in India affects women's lives from birth with the child mortality being 61% higher for girls than for boys (FSG, 2016). Women are expected to take care of the household, and to accept that they are not supposed to get educated or realize their full potential (FSG 2016).

### **6. FAMILY TIES AND HIERARCHY**

In the patriarchal society of India, the woman is

affected by family ties in which she is positioned at the bottom. (Allendorf, 2013). Even when living in a nuclear family, the importance of kinships can affect the freedom of women (Jacobson, 2004). With menstruation in family, women feel uncomfortable to assert their needs and therefore follow what they are told. Men are not educated on the subject and therefore cannot fully support women (Mahon et al., 2015).

## 7. SOCIETAL VIEW

The effect of the societal view of a menstruating woman can be connected to the view of purity which influences the position of the person in society. Menstruation being seen as impure therefore leaves women to be forever inferior to men (Jacobson, 2004). The negative societal view of menstruation and the secrecy around the subject forces women to hide their menstruation(Allen et al., 2011).

## CURRENT EFFORTS

Before developing interventions, it is important to learn about the existing attempts (Dorst, 2015). In the recent years, the Indian government has addressed the issue around menstruation and has created activities to tackle the issue, mostly under the WASH sector(water, sanitation and hygiene). The entertainment and media have as well tackled this topic in order to bring the subject to a wider public. This demonstrates that a general awareness around clean sanitation for women is on the rise, with attention being paid to supply sanitary products to those in need. However, more efforts should be directed to the underlying issues such as stigma and taboo which have often been disregarded as a point of focus for creating a change (Lieberman, 2018).

## CONTEXT OF INTERVENTION: FAMILY FOCUS

The first step needed to create a change is to have open and free of shame discussions around menstruation (Bhattacharjee, 2017) which also involve men and boys for the changes to appear in the entire society. This has been taken as the focus of our RTD (research through design) project.

As mentioned in the constraints, Indian society and culture are largely collectivistic and family values are put on the forefront. Therefore, to address the taboo and create an intervention, the comfort and security of the family home was taken as the context of action. It was essential to include all family members into the discussion, especially the fathers who as heads of the house have a direct impact on the lives of women and the way they conduct their periods. Moreover, creating a more positive view of the taboo inside the family home could lower the impact of the societal negative view. The conversation on menstruation mostly occurs between female family members who are also the ones who often pass the old practices. The education in school is lacking to eradicate these often dangerous practices as there is no proper curricula(taken from interviews). Research showed how the youngest ones, the pre-menstruating girls, are the ones that are the most vulnerable ones. They are often unaware or uninformed of the occurrence of menstruation leaving them with high levels of fear and anxiety once they receive their menarche. For this reason, the target of the project became pre-menstruating girls.

## BUILDING BLOCK 3: FIND YOUR LOOPHOLE

When designing for taboos and stigmas, it is important to bring a new way for people to engage with the topic, but at the same time to allow the freedom to decide how close or distant they wish to be from it (Fields, Sinclair & Valdes,



2010). For this project, we used gamification. When working on taboos, it is important to find a subtle and non-intimidating way to infiltrate the topic. The engaging and interactive aspect of the game can distract from the existing taboo and stigma and subtly infiltrate the topic. It can serve as a first step for a discussion, as an ice-breaker. The inclusive part of gameplaying allows for the discussion to occur naturally and therefore non-directly include male members of the family into the discussion on menstruation. Moreover, gamification makes the discussion easier, and the topic lighter- it can turn an uncomfortable and awkward discussion on menstruation into a fun competition.

Sorcar states how gamification has the power to minimize stigmas (Sorcar et al., 2017). Games are interactive and can make people aware of their actions, as well as their behaviour towards the subjects. A new behaviour can be tailored through a repetitive exposure of certain information which can contribute to normalization of the subject. Here, Gamification was seen as a benefit for each family member as well. Male members get a chance to learn about the subject and understand the experiences of their family female members. Female members get to question the old passed on practices, and the daughters are given space for questions and help inside the safety of their family homes.

Four games were designed with different types of interaction and forms of game playing, differently provided information and different openness of the subject (figure 2). The reason for creating four different concepts was to find which design succeeds in creating the best atmosphere in the family home around menstruation. Two educative games were tested - Puberty Flute (board game) and Memory Game. Other two games more focused on the game playing – Giggles, which serves as a conversation-starter, and Mix-A-Body-Match, as an ice-breaker. All of the designs included a booklet, as an educational component

of the design to provide family with information, even after the game playing.

In order for the conversation to occur in the family home, it was important to find a way to include menstruation in the designs without putting a focus on it to attain the involvement of all family members and avoid opposition. That was why none of the games were stated as games on menstruation, but rather as games on puberty, growing up or even as “uncomfortable games”. All of the designs included subjects such as biology and puberty, and portrayed the changes that occur both in boys and girls. Here the intention was to present menstruation as a natural and accompanying part of puberty, along with the others that the girls share with boys.

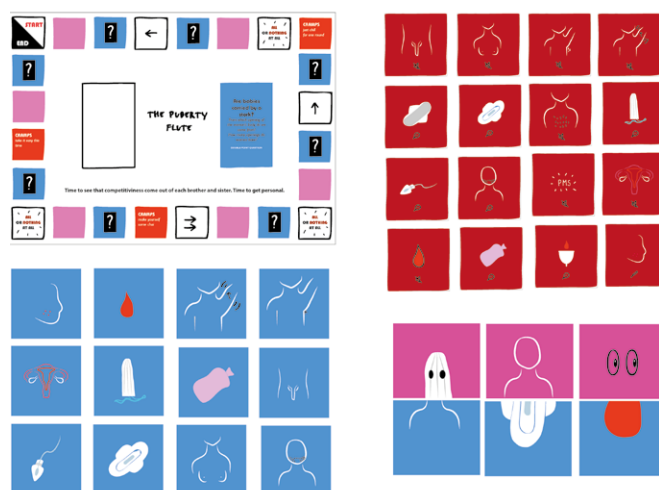


Figure 2. Examples of the 4 designs (described top to bottom) - board game “Puberty Flute”, a combination of pictorial, charades and alias “Giggles”, “Memory game”, pairing game “Mix-A-Body-Match” (Own design, 2019.)

#### BUILDING BLOCK 4: SET THE MOOD

Humour can be used as an ice-breaker to talk about something that is initially uncomfortable. Furthermore, it can be used as a way to reframe the stigma (Van der Lande & Vegter, 2015). Menstruation, puberty and private parts are subjects that are rarely discussed in families in

India and approaching topics with humor could make the subjects lighter. Humour can also help in normalizing those subjects. Dr Ivan Brown from the University of Toronto, who works on special education and disabilities, states the benefits of using humour when combating stigma: “Humour gives us the opportunity to explore things beyond our usual mindset. Most problems will disappear or become less problematic, when there is something to laugh about (...)” (Van der Lande & Vegter, 2015). In our project, humour was used by forming humorous questions in the board game Puberty flute and in the Mix-A-Body-Match, where the aim was to win the game by forming the funniest combination (figure 2).

#### **BUILDING BLOCK 5: BRING EVERYONE ON BOARD**

In order to have a deeper understanding of the issue and of the context, it is beneficial to involve those in the field. Our project consisted of a 3 month field research in India. The first part of the research in India were the interviews with experts in Mumbai from different fields whose work involves menstruation. The interviews helped in the deeper understanding of the context through the existing practices, personal experiences and encounters in the field when working on the taboo. The interviews also consisted of receiving feedback on the design ideas prior to the testing. The second part of the research was collaboration with Sukhibhava, an Indian NGO based in Bangalore that aims to educate women of lower income on proper menstrual hygiene practices. The collaboration helped in tailoring certain aspects of the design to form a careful interaction with each family member. This was done through a detailed attention of the design of the visuals, of the tone of the design (funny or serious), to the analysis of the effect of the design on each family member, especially on the male members. Tailoring these aspects carefully can ensure adoption of the design (Sorcar et al., 2017).

#### **BUILDING BLOCK 6: CREATE A CULTURE – FIT**

When designing a product for a specific context, the design should be customized to the culture to increase trust in the user (Sorcar et al., 2017), and when working on a stigmatized topic and in a sensitive context, it should be approached extremely carefully. The intention was to make a product that will make people more comfortable and open to talk about the subject of menstruation. Therefore, it was necessary to create a visual style that will be natural to the family, and not seem as an “imported material”. The explorations were made through the patterns, the colour combinations and the visual characters/content of the cards.

#### **BUILDING BLOCK 7: TEST, ITERATE, TEST, ITERATE**

When designing for taboos, it is important for the design to undergo a series of tests to check the acceptability and appropriateness of different elements of the created design. The second part of our research was testing with nuclear urban families with at least one daughter of the age of 11-18 years old. The tests were conducted with interviews and tests of the 4 games with the RtD approach. In RtD, design actions serve as a way to gain knowledge (Stappers & Giaccardi, 2014). The aim was not only to get the response to the designs, but honest reactions to the stigma. The tests have proved how all families, no matter the strata, experience initial discomfort when exposed to the topic of menstruation with all family members due to the tradition and the negative societal view. Despite the taboo, the families were reluctant to stop playing the games. Certain aspects of the game - competitiveness or timing and humour, made the family involved in the game and enjoy it, even though it was on menstruation. Conversations on menstruation usually do not occur in the family. They are uncomfortable,

but with the help of the games “ it was a less awkward way of speaking the same thing, but not going through the cons of having the conversation.”

The concept of the pairing game, Mix-A-Body-Match (figure 3), was taken as a final one as it has created the best atmosphere in every family. Aim of the game is to win by creating the most funny pair out of the given material. Mix-A-Body-Match was different from the rest of the designed games as it included additional content apart from puberty and menstruation, thus making the game playing more entertaining, and even surprising and less serious. Players could get creative and imaginative with the content that is perceived as a taboo, and pair them with daily objects to turn the taboo into a humorous content. By using the additional content, the game has put menstruation on the same level of discussion with the mundane objects, such as flip flops, funny eyes etc.(figure 4) and that way presenting menstruation as something that is not avoided or hidden. The humorous aspects of the game and the laughter eased the topic and allowed for easier conversation.



Figure 3. The outcome design “Mix-A-Body-Match” with a box, cards and booklet (Own design, 2019.)

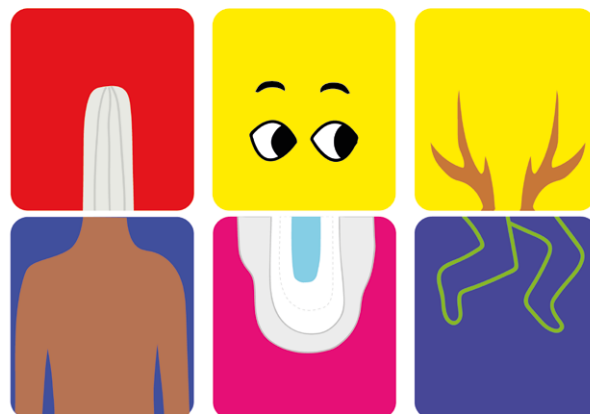


Figure 4. Funny combinations made during the testing with Mix-A-Body-Match (Own design, 2019.)

Mix-A-Body-Match was also shown as the best fitting concept for the youngest generations as it did not require prior knowledge and thus removed discomfort of involvement in such a topic. Moreover, the concept was favoured by most male members as it presented the topic of menstruation as simple, easy and light, and not the usually uncomfortable one.

## CONCLUSION

Taboos and correlating stigma around subjects have a strong impact on the well-being of people. It is necessary to tackle these issues since not addressing them leaves the subjects in the dark without allowing for change to occur. This paper presented 7 building blocks on how to design for taboos which have been defined in our RtD project on taboo of menstruation in India and are illustrated in our approach. Women all over the world face many issues during their menstruation, but in the LMI countries such as India, the taboo affects women’s health, education, economic possibilities, relationships and overall well-being. The current situation around menstruation in India has been cultivated through centuries and is hard to change but the

first necessary step is to open up a discussion in order to bring the topic out of the darkness of taboo and stigma. The goal of this project was to enable discussion on menstruation in the family home by creating a positive atmosphere in order to enhance the well-being of pre-menstruating girls. This has been achieved through an engaging and interactive aspect of gamification, and with humorous aspects of the design, the usually the uncomfortable conversation has been turned into an engaging and fun competition.

## RECOMMENDATIONS

The presented building blocks can serve as a reference for further work on taboos, but they require adjustment or modification through further work. The paper shows the potential for further addressing to be made on the societal and cultural aspects when interfering with sensitive topics such as taboo. Understanding the intricate aspects of the culture such as gender and interpersonal relations is of high importance as it can give the full comprehension of the issue.

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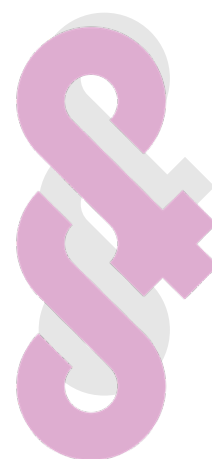
# Designing for People

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## Abstract

“We have to use experience for what it guarantees, but also free ourselves from it when it holds back. (...) drawing has earned a lot of strength, exactly for the perception of how it is important to learn to observe, which is fundamental for architects and for all people. Learning to see, not only to look, but to see in depth, in detail, in the whole. “ (Almeida, 2003). Architecture encompasses a wide range of knowledge, from drawing, art, mathematics, history, engineering, among others. It gives us the power to creatively design spaces for people. It can transcend functionality and be a work of art that rouses feelings and insight. It also evolves along the time, space and society in which it operates. Regardless of design, form or scale, it meets physical or social needs. Since architecture is made of people and for people, it is necessary to understand who these people are and their respective necessities. In the contemporary times in which we operate, it is already recognized that the average- man model and his physiology cannot be the basis of drawing. In addition to each person’s individual physiology, we must also consider the physical abilities over time and life. In this sense, the project embraces children, men and women, the elderly, people with disabilities and / or people with reduced mobility, that is, the space has, in its creation, to be for the diverse and functional diversity. In the practical field of architecture, various denominations and labels have been given to the physical act of inclusion, such as that of accessibility. This undertaking has been seen and practiced with normative application due to its inherent complexity. In this sense, it is often only applied by simply adapting the entrance with a ramp. The real issue in this necessary case focuses on the culture of thought. A practice that uses language is not a technique. When we conceive or design as techniques we tend to lean towards a particular shape, as if it were not the result of a concern about what we mean to say or how we want to do it. Social issues, barriers that raise boundaries of differences, and dominant paradigms can be changed with a different culture. Architects have the power to design from a macro scale, that of the cities, to a small scale, such as houses. The built environment further promotes a structure that creates separations and parcels out differences in class, gender and physical abilities. “Architecture has the ability to transform the way we see and experience the world. This power is unquestionable and often underutilized” (Gerente, 2016). The concepts of inclusion and functional diversity have not been reflected in current design concerns. As architects, how can we design solutions that make substantial contributions to everyone’s life? From these concerns and emerging needs, we intend to demonstrate the importance that well-designed local thoughts and solutions can have in society, which can possibly transgress the place, demonstrate and inspire, ultimately serving as an example for global actions. We intend to analyse and present examples



that may be referential. In the coming time, society must move towards a dilution of concepts, “where everyone will be so embedded in the context of everyday life that no label will fit them. Architecture must be connected in order to act with the creation of new spatial understandings, to open the way for other visions that will allow a greater infiltration of these layers in society with the production of more plural, open and democratic urban spaces” (Gerente, 2016). The world can be totally invented, but it can also always be questioned. It is necessary to produce culture and to produce representations.

**Keywords:****Designing, People, Representations, Diversity, Space****REFERENCES**

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# Track

## Design for Social Innovation, Circular Economy and Sustainability

*Design for social innovation and design for sustainability usually walk hand in hand. However, design for social innovation differs from design for sustainability in the sense that the latter tends to have a more technical approach to the intervention and construction of the artificial world, whilst the former tends to have a more “liquid” and enabling intervention in the way people organize and are called to act on behalf of a common well-being. This track aims to inspire scholars and practitioners to rethink and pursue the fundamental idea that the circular economy fosters the conditions for innovation and creativity in order to develop (g)local solutions to meet social, eco-friendly and economic needs.*

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# Lérias Lace: sustainability products Design

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## Abstract

Lérias Lace and Innovation are the two major focuses of this research - by identifying the focus the questions arise - Is it possible to develop garments with the application or use of Lérias Lace? Will it be possible to reinterpret this cultural element in new fashion design products? It is around these questions that the objectives began to be outlined.

The Lace of the Leagues is an identifying element of the culture of a small village in the interior of the country and presents itself as a reference of the cultural heritage and the history of the people of Póvoa da Atalaia and is traditionally used mostly naperons, towels, etc. .

The richness of this heritage element lies essentially in the knowledge and technique of its execution. It also becomes rich by its social character through the involvement of older people in the transmission of knowledge that goes from generation to generation. This richness is also represented in the way this cultural element has been interpreted in the creation of other products.

The methodology consisted, in a first phase, of research and literature review on the theme - Tradition, Innovation and sustainability. This was followed by the preparation of a briefing for a national competition that resulted in the obtaining of new proposals or concrete ideas for the interpretation of the Lérias in different supports and forms.

The products resulting from the initiative should reflect the use of an element of culture and the tradition of a region in a contemporary approach where the work of fashion designers is presented as a differentiating element, important for adding value and sustainability. The Income of Lérias Lace, as a traditional element is associated with innovation by creating new proposals.

## Keywords:

**Sustainability; Cultural Heritage; Traditional Lace; Education; Fashion**

## 1. INTRODUCTION

The Lérias Lace, is a crochet lace, characterized by the execution of a long loop stitch alternating with two closed stitches allowing for the creation of a very interesting aesthetically / visually texture / pattern.

This lace is an element of the cultural heritage of a region in the interior of Portugal - Póvoa de Atalaia, in the municipality of Fundão - and was traditionally used mostly in household textiles such as sheets, decorative cloths, towels and, less often, motifs for use on garments such as collars. In a religious aspect, we highlight the use of this crochet lace in the Porridge Procession, as a cover for the crocs that the curates carry on their heads.

Social sustainability is the motto for the development of this research and is based on two important pillars: on the one hand, in product development through the reinterpretation of an important element of a region's heritage, on the other, the fact that it involves elderly women in the transmission of knowledge, seeking to motivate young people to continue this craft technique.

The main objectives of this research are: To know the technique for the creation of the Lérias Lace; to generate new knowledge around the craft technique; reinterpret Lace in creating new products in Fashion Design, Accessories or Home Textiles; Promote the reinterpretation of the Lérias by Young Fashion Designers; Promoting Innovation in Lérias Lace,: application to Fashion Design - clothing and accessories; Transfer knowledge to younger people; continue having proceeds and promote social sustainability through the involvement of advanced women in the transmission of knowledge.

## 2. SUSTAINABILITY AND CULTURAL ISSUES

Considering a first approach on the meaning of the word, the term sustainability itself originates in the French verb soutenir, "to hold up or support" (Brown et al., 1987). The term does imply limits, however according to (Caniato et al., p. 660) sustainability means, considering the Bruntland report (1987), "being able to satisfy current needs without compromising the possibility for future generations to satisfy their own needs". Thus, it is a concept that can be posed and has a transformation of human lifestyle that can optimise health, well-being and security (Geissdoerfer et al., 2017) and not less important the re-use, re-think and reduce product concepts. Assuming that sustainability has been emerging in the last decade as a megatrend (Henninger, et al., 2016) the industry and the creative scenario in fashion has also been drastically changing. This change is mainly related to the awareness of consumers that are now more aware than ever of the issues that came from to the fashion products manufacturing processes.

Having in mind the triple bottom line approach, that considers that the tree pillars of sustainability are based on people, profit and the planet (Elkington, 1998) each fashion company should consider operating their business in order implement and achieve new sustainability practices.

The sustainable development follows the point of view of several authors and is classified into three groups: (1) Financial; (2) Environmental and (3) Social. For a development to be sustainable, it is fundamental to have an action in the life cycle of the product, from raw materials to packaging, transportation and conservation. Thus it only being possible when the various players are involved, starting with training and involving the industry, commerce and community in the

process (Seuring & Müller, 2008; Carter & Easton, 2011; Dyllick & Hockerts, 2002).

One of the failures encountered by researchers resides in the necessity to gain cooperation throughout the supply chain for the objectives related to sustainability to be achieved and for social and co-operative politics (CRS) to be developed (Seuring & Müller, 2008).

Manzini (2015) say:

“.....in a highly connected society designing participants cannot escape from interacting and influencing each other. Therefore, being influenced by different participants every design process is, de-facto, a co-design activity. That is a complex, contradictory, antagonistic process in which different stakeholders, design experts included, participate in different ways, bringing their specific skills and their culture. In other terms, co-design, as intend here, are social conversations in which everybody is allowed to bring ideas and take action, even though these ideas and actions could, at times, generate problems and tensions. Therefore, a co-design process is not a space in which everybody agrees and speaks the same language. It is a process in which different people with different ideas and languages interact and, sometime, converge towards common results. In turn, these results, precisely because they emerge from a dialogue among different ideas, can be particularly interesting, resilient and rich in cultural qualities”.

A range of initiatives by institutions and companies are being undertaken to reflect on sustainable teaching and practice versus curriculum of fashion courses and foster cooperation along the chain. For example Williams, D. (2016) and Fletcher, K. (2015) from London College of Fashion (LCF) at University of the Arts, London (UAL) and a partnership with research Centre for Sustainable Fashion, (CSF) where fashion is explored as a means to better live through sustainability with the Kering group. The development of this study identified

in the literature sustainability in the economic, environmental, social and cultural areas have which been developed as theoretical contributes. Thomas (2019) conclude in their research, how the social movements and cultural trends help to shape people's commitments to certain kinds of sustainability and condition their adoption of particular sets of practices both at work and at home. The richness of cultural traditions are a current source of inspiration, which associated to new technologies for allow the development of differentiated products with added value, adapted to consumer's desires.

From a social sustainability point of view, the project of applying Lérias Lace, to clothing, accessories and home textiles fits in and is extremely important, especially in an aging region of the interior of the country.

### 3. HISTORICAL EVOLUTION OF LACE AND CROCHET

#### 3.1 LACE

Lace is constituted as a group of textile arts, characterized by the use of a needle (sewing or barb / barb) or bobbin (Perdigão & Calvet, 2002, p.19) and formed “by successive or stranded crossing of textile yarns” (Magalhães, 1963, p.110). Thus one obtains “a purely decorative free-form fabric which, throughout history, has been coveted, stolen, and smuggled,” given its luxurious character, “made by the poorest women to adorn the rich” (Leslie, 2007, p.107).

The earliest known lace from Western Europe dates from the fifteenth century and was used to decorate clothes and show wealth. (Leslie, 2007, p.107)

In Portugal it is supposed that the word Lace was first used officially in the reign of D. Sebastião, in pragmatics dating from 1560, but previously, at least in 1209, was already documented in

Portuguese (Magalhães, 1963, p.117). Magalhães (1963), with regard to Portuguese hand lace, divides them into needle lace, executed “with the aid of drawing, made on rigid support, canvas” (p.110) and bobbin lace. Crochet lace is considered, by this author, to be one of the popular lace of secondary importance, along with the five-needle lace, frillette, hook lace, Tenerife lace, mixed lace, net lace and knot, the embroidered lace on the tulle, the macramé. More recently, Perdigão & Calvet (2002) present a list of Portuguese lace, which includes the “rotating lace (crochet with the strap attached to the shoulder, as a way of tensing it), along with the bobbin lace, the lace of the nozinho (knot), the fillet lace and the lace of two, three or five needles” (p.19).

In most rents are used “yarns of various types from metalized yarns (silver and gold), natural textile fibers (silk, cotton and wool) and human hair” (Perdigão & Calvet, 2002, p.22).

### 3.2 CROCHET

About Crochet lace is characterized by a single hook needle (also known as a barb or barb needle), and with only one thread that interweaves in itself, “not only vertically with the previous row (...), but laterally as well - with others in the same row” (Emery, 1966, p.43). If the yarn is interwoven in the same way and in all the loops of the previous loop, the slip-stitch crochet is the least complex form of closed work (Karp, 2018, p.208); if the loops of the previous loop are not all worked “forming instead of shorter chains attached to the growing fabric at intervals, the result is termed openwork crochet” (Karp, 2018, p.208).

Shepherd (2003), using the technique as the main classification criterion, divides crochet lace into simple lace crochet, filet crochet, relief or Irish crochet and hairpin crochet (p.18).

The term crochet, as far as Europe is concerned,

appears only in registers after 1800 (Paludan, 1995). However Karp (2018) points out that the “crochet was clearly in gestation before the outset of the nineteenth century” (p. 221). They therefore maintain that the detailed description “of both closed and openwork (...) and their juxtaposition in the same piece of fabric together with more complex crochet stitches, signal to a point at which the label can be applied generically to all manifestations of the craft.” (Karp, 2018, p. 221). Studies in this area show that the first crochet patterns / motifs were published in the Netherlands in 1824 (Leslie, 2007, p.xviii).

Crochet is mainly used in home textiles, but is also used “for clothing and accessories such as aprons, shawls, collars, cuffs, scarves, handkerchiefs, headwear, purses, socks, and gloves” (Leslie, 2007, p.50).

## 4. LÉRIAS – SOLOMAN’S KNOT STITCH

The Lérias stitch, is currently known in many countries as the Solomon Knot, it has been used at least since the late nineteenth century; An 1885 publication presents an illustration of this stitch, applied to a mixed lace (figure 1) without, however, mentioning its name. (Parker, 1885, p.10).

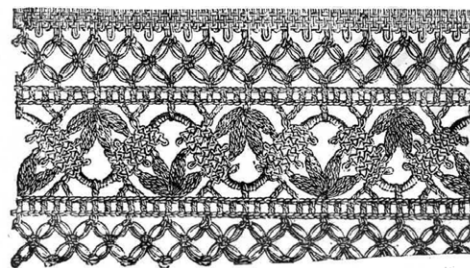


Fig. 1 – Illustration of Solomon’s Knot Stitch Set on a Mixed Lace. Source: Parker, 1885, p.10.

Other designations, however, are used to designate this stitch. By way of example we refer to two publications, one in English and one in



French, already from the twentieth century. In the English language publication the point of the Lérias Lace stitch is called “knot stitch” (Batt, 1916, p.22) whereas in the French language the designation “point de gibecière” is used (Jocelyn, 1928, p.12).

In Portugal, in the 50's of the twentieth century the publication by Laura Santos “The Needle Encyclopaedia” presents the description and illustration “of the Lérias Lace”: “To start the lérias part a cord is made, and then a simple loop, then an elongated loop in the air and another simple loop attached to the back line of this loop. Resume again, a simple loop passing two loops over the start chain, a simple loop over the next one, and so on.” (Santos, n.d., p.188) (Fig. 2).

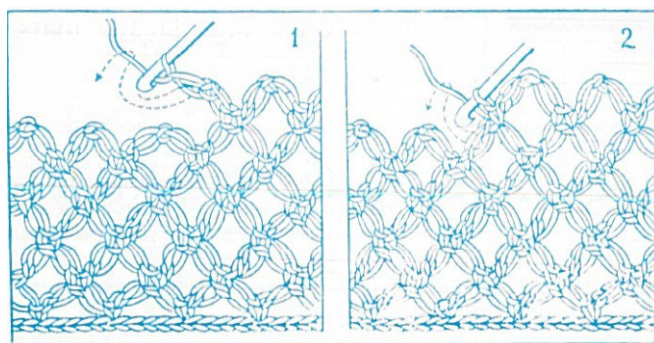


Fig. 2 – Illustration of Lérias. Source: Santos, L, (s/d)

Magalhães, in the text “Embroideries and Lace of Portugal.” (First edition dates from 1956) also refers to the stitches and shells, “employing the secret stitch” (p. 158), as one of the most popular crochet stitches. Generally this is a crochet stitch “made up of a series of intertwined elongated hoops producing a net-like effect” (Reader’s Digest Selections, 1985, p.365). To achieve this effect correctly, it is necessary to “pay special attention to where the needle must enter to make (... the...) simple knot” (Reader’s Digest Selections, 1985, p.365) that joins the elongated rings. The use of Solomon’s knot with other crochet stitches and other textile arts seems to have been

a trend in Portugal for decades. Santos presents a “decorative cloth” that combines “vulgar crochet”, stitches and hooked ones. (n.d, p.133) (Fig. 3).

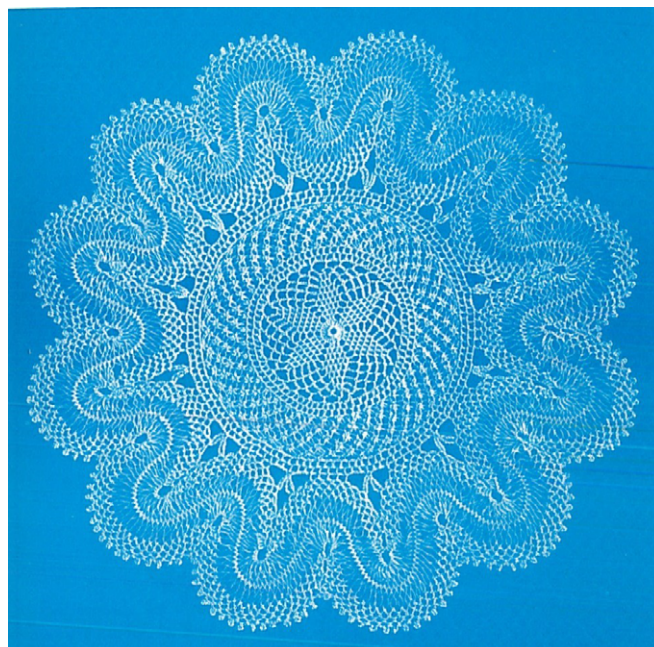


Fig. 3 – Decorative cloth with “normal croche”, stitches and shells. Source: Santos, L, (s/d)

One of the essential products of traditional Nisa costume, a locality in the Alentejo interior of Portugal, are the shawls, embroidered to the chain, polychromatic. White shawls, made of wool, used during the Carnival, are applied with fringe where they integrate the stitches, as a characteristic element of this product (Nisa City Council, 2009) (Fig. 4).

In macramé there is a knot called Solomon’s knot which, executed in such a way as to use half the threads of each knot from the previous loop to a new knot on the next loop, produces an aesthetic / visual effect very similar to the crochet stitch.





Fig. 4 – Nisa Shawl fringe application used as Lérias Lace  
Font: <http://museubordadoebarro.cm-nisa.pt/pt/embroiderytypes/>

## 5. LÉRIAS IN PÓVOA DA ATALAIA

The Lérias Lace (Fig. 5) is characterized by the conjugation, in almost all its variants, of Solomon's Knot stitch with the Shell stitch or with rectangular elements formed by simple braids. In this village Solomon's knot is commonly referred to as "the open ones" while the Shell point is known as "the closed ones". Dona Maria de Lurdes knows, however, the technical name Shell stitch, but throughout the interview she never referred to the Lérias Lace, "the open ones", as Solomon's Knot (Interview 1).

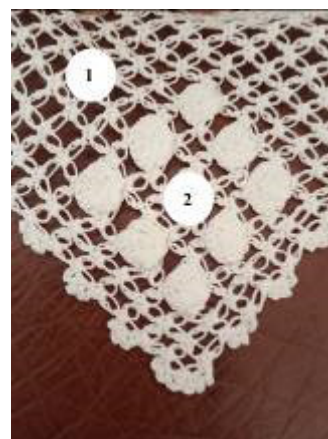


Fig. 5 – Lérias Lace : Lérias or Solomon's Knot (1); Shell stitch(2).

The material used for this crochet lace is three-strand mercerised cotton twine, with a thickness ranging from 60 to 12, usually white but also in pastel colours, worked with a steel needle. barb to cotton thread number 12; for cotton thread number 20; and for cotton thread number 60. In Póvoa de Atalaia the Lérias Lace has been known for at least a century, since the 90-year-old D. Maria da Cruz Nabais has been making this lace since she was a child, and her deceased master, also resident in this village, D. Maria de Jesus Henriques, knew this technique before. During the twentieth century, especially in the early decades, almost all girls of marriageable age had, in their trousseau, various textiles where the application of the Lérias Lace could not be missed: a sheet with two pillows and a pillow, bedding and towel (Interview 2). Thicker cotton yarn, number 12, is used for interweaving; already in decorative cloths and other smaller products, thinner yarn is preferably used, from number 20 to number 60. The ladies interviewed remember the line "Alsace, which was more twisted, more resistant", referring to a cotton yarn brand (Interview 3). If at the beginning of the twentieth century the Lérias Lace was applied to household textile products, made with cotton thread, in recent decades some ladies started to apply this lace

to other products, namely to garments and accessories using, in their execution, a thicker yarn of varying composition (especially a mixture of textile fibres) which D. Maria de Lurdes generically called wool. (Interview 1)

In Póvoa de Atalaia one of the events that mobilizes almost the entire village is the Porridge Procession, in honour of Saint Sebastian (Fig. 6).



Fig. 6 – Procession

The feast dedicated to this Saint was celebrated some years ago on January 19th, but today the festivities take place on the third Sunday of January. On this day 24 curates carry on their heads trays (with offerings of “coscoréis” a sweet flour pastry and white corn porridge), coated with either decorative cloths or towels, enriched with lace, among which is often the Lérias Lace. These decorative cloths and towels are used in addition to the white colour, cotton threads in pastel colours, beige, yellow and pink, most often. The feast dedicated to this Saint and the traditional Porridge Procession dates back to “ancient times when there was a locust plague and people promised to make the procession every year” (Interviews 1, 2 and 3). Thus, while in the procession itself it is the ladies / stewards who carry the offerings, later it is the ladies / stewards who have the task of distributing the offerings to all those present.

The traditional is made with a hook or barb

needle, worked with the left-hand cotton cord (Fig. 7) or, alternatively, with the right hand and, in this case, pinned to the shoulder ( Fig. 8).



Fig. 7 – Lace made with a cotton thread under tension with the left hand



Fig. 8 – Lace made with a cotton thread on the shoulder under tension with the right hand

From what has been collected, it can be said that the Lérias Lace is applied differently in various textile products. Thus, there were round crocheted decorative cloths with alternating crocheted circular crowns in Solomon’s knot and in simple braids forming 3-turn modules, each with 9 or 10 simple braids (Figs 9 and 10).



Fig. 9 – Round decorative cloth: Solomon’s knot and the closed knot

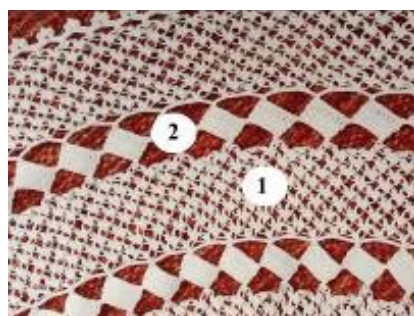


Fig. 10 –Round Decorative cloth : Solomon’s knot(1) closed (2) (detail)

Another option, very common in Póvoa de Atalaia, is the application of a crochet lace, in linen or cotton fabric, with a square or rectangular shape, where the Solomon's knot and the Shell stitch are always combined with a peak. In this case lace can be applied only on one side of the fabric (on hand towels and intertwining, for example), on two opposite sides (on pillows and decorative cloths, for example), or on all four sides of the fabric. fabric (in decorative cloths and pads, for example). In the latter case the lace has corners, which constitute the most complex element of execution: "they are more difficult to do because there are no drawings, we have to think about how to do it" (Interview 2). The "beaks", an expression which the interviewed ladies use to designate crochet bars, also vary in both their width and the way they combine Solomon's knot and Shell's knot. In some examples the Shell stitch is presented in a simple module that goes with both sides of the lace.

In other cases there are products where the Shell stitch is grouped in modules from 2x2 to 5x5, forming rhombs. The larger the shell stitch (Fig. 11) used, the longer the time required to perform the lace and it will be as the "closed ones" running with 8 or 9 high braids / stitches which significantly increases the execution time.



Fig. 11– Rectangular decorative cloth with the Shell stitch in modulus of 3x3.

Another aspect that differentiates the products where the Lérias Lace is applied on linen or cotton fabric is the ornamentation of it with open sheaths and white embroidery (Fig. 12) or only

with polychromatic embroidery (Fig. 13) which, for example. On the other hand, they contribute to product customization.



Fig. 12 – Rectangular decorative cloth with crochet lace, open seams and white embroidery



Fig. 13 – Rectangular decorative cloth with crochet lace and polychromatic embroidery

It should be noted that for the interviewed ladies there is no unanimity regarding the law of this point; the shells are both convex and concave. A 1 meter long strip made exclusively with Solomon's knot (nine Solomon's knots) takes an average of 10 to 15 hours to complete. Dona Maria da Cruz Nabais regrets the long time she currently needs to make this lace, about twenty-five hours. It is a very time consuming job that is done to take up time and not for profit (Interview 3).

For the application of the Lérias Lace in the coordinates / pieces of the fashion shows strips of lace are crocheted exclusively to Solomon's knot for a matter of time.

## 6. LÉRIAS APPLIED TO CLOTHING

The methodology for the implementation of this project focused, in a first phase, on the research around the knowledge of the locality, a small village of Fundão, where the Lérias Lace are made. After knowing all about this land, we sought to establish partnerships that could strengthen the implementation and dissemination of the Lérias Lace project. The partnership between the Fundão City Council and the Póvoa da Atalaia



and Atalaia do Campo Parish Union with the two Higher Fashion Design Institutions in the region - ESART / IPCB and UBI, strengthened the project. A contest was created for young designers or students of Fashion Design at partner institutions and others in the country. The purpose is to develop clothing, home textiles or accessories with the application or reinterpretation of Holiday Lace.

The invitation was made to a nationally renowned Designer to join the Competition Jury - Carlos Gil - Designer born in Fundão and with studio there, to reinforce the importance of this project. The participation of the Designer in the jury allows us to increase the creative and execution quality of the proposed new products.

The invitation was extended to other elements, equally important, to join the jury and that can greatly contribute to publicize the project, such as the Selective Fashion Association, in the figure of Dr. Manuel Serrão.

The result of the contest is presented annually in a Fashion show, at Póvoa da Atalaia.

Póvoa de Atalaia is a Portuguese town in Fundão, with 12.67 km<sup>2</sup> and about 500 inhabitants. It was the seat of an extinguished parish in 2013, as part of a national administrative reform, to, together with Atalaia do Campo, form a new parish called Union of the Parishes of Póvoa de Atalaia and Atalaia do Campo.

The village has two traditional festivals: the Porridge Festival, held in January, and the Feast in honour of St. Stephen in September.

In Póvoa de Atalaia the poet Eugénio de Andrade (1923-2005) was born and lived his childhood until 10 years old, when he moved to the city of Lisbon.

The design of Lérias Lace Moda is already in its 5th edition and has seen a great evolution, both in the various product proposals presented and in the parade's own format.

The proposals include the reuse of materials, with a sustainable view of fashion, with the application of lace from the most important feminine fabrics (Fig. 14), still appearing in the first edition of the contest, in 2016.



Fig. 14 – Lérias Products 2016

In the last edition of the Contest proposals were already presented for Children, Men and Women, and the approaches to lace are very diverse, namely with prints, dyeing and manipulation of lace and their direct use in the proposed garments



Fig. 15 – Lérias Products

## 7. 2019 COMUNICATION OF THE PROJECT “LÉRIAS – A ARTE DAS LINHAS” (THE ART OF THREADS)

Today, Portugal is facing the demands of a new, globally more competitive market. In this new economic context, interconnected by lattice structures, geographical distance is a variable that is losing importance allowing, with the implementation of integrated communication strategies, to catapult to the centre of world interest, the cultural manifestations of each of the different peoples. In sharing cultural experiences and traditions that have an economic potential to exploit, local tradition is raised to the maximum exponent of the global. Promoting local heritage thus brings innumerable challenges and consequently great opportunities and it is in this precise context that the “Lérias - The Art of the threads” Project, organized in partnership by the Municipality of Fundão and the Parish Council of Póvoa de Atalaia and Atalaia do Campo. Communication of this project is of the utmost importance. This is where a set of initiatives include:

- “Lérias: The Art of Threads - 2019” Competition to raise awareness among young fashion designers, and the general public, of the

importance of maintaining the traditions of Lérias Lace and applying them to the development of new fashion products. added value incorporating the artistic and craft traditions of the region.

- Contest “Traditions of Beira Interior in Fashion - 2017.

- Fashion Show for the presentation of the works for the competition, resulting from the partnership of two Higher Education Institutions of the Region, which integrate in their training offer the Fashion Design course, the Polytechnic Institute of Castelo Branco (School of Applied Arts). and the University of Beira Interior. This event took place in 2017 and 2019.

The communication strategy is intended to participate in National and International Fairs, where will be exhibited the winning products of the contest “Lérias: The Art of threads”.

The implementation of this project fits in the context of the establishment of strategic partnerships at regional and national level, with a view to raising the economic interest for the production and creation of new products with Lérias Lace and thus enhancing the cultural heritage of this region increasing its economic competitiveness.

## CONCLUSIONS

The challenge of applying and reinterpreting the Lérias Lace in the design of garments led to the search for knowledge of the history and production method of this cultural product.

Key elements resulting from research such as technique, production mode, raw material, applications, stitch types and details will determine the choices and influence all the aesthetics and narrative to develop.

The Designer seeks their inspiration through research and reveals their own sensitivity and visual aesthetics in the development of unique pieces that unify the initial concept as a whole. You can reinterpret Lérias Lace by giving it a new approach associated with Product Design. As a result, its diffusion is shown on the one hand to reinforce the identity and culture of a region, on the other hand it can boost the development of production for these products by increasing their demand.

The development of the Lérias Lace project is an important project for sustainability, and cultural sustainability, as it seeks to reinterpret an important element of land culture - Lace.

Also, Sustainability at the social level, as it involves older women in the realization of Lace; Village children on the fashion show runway presentation while also involving and sensitizing young designers to the use of lace in their product proposals;

It is possible to develop product proposals by applying the Lérias Lace that may be of economic interest.

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Interviews to:

Maria de Lurdes Luciano – 57 anos (Interview 1)

Rosa Milheiro Domingues – 84 anos (Interview 2)

Maria da Cruz Nabais – 90 anos (Interview 3)

# Emotional Components in Consumer Decision Making Process. An Application in Sustainable Fashion Product.

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## **Abstract**

The aim of this paper is to analyse the emotional component of the consumption experience in the context of sustainable fashion. The study offers categorization of the concept of emotion based on the current consensus. Following the analysis of the main scales used for the measurement of emotion in the domain of consumption, the development of a specific scale that identifies emotions induced by sustainable garments is proposed.

## **Keywords:**

**Sustainable fashion, emotion, consumer decision-making process**

## INTRODUCTION

Clothing production generates about eight percent of greenhouse emissions and is responsible for about twenty percent of water pollution. During dyeing process alone up to two hundred tons of water per ton of fabric produced are being consumed (Greenpeace, 2012), and that is without taking into the account the environmental impact of the chemical substances used. The industry model based on fast fashion is linked to overconsumption of clothing which in 2017 stood at 62 million tons and is estimated to reach 102 million tons in 2030, which represents an increase of sixty-three percent (Greenpeace, 2018). The enormous environmental impact of textile production requires reformulation of the current fashion system by adopting approaches that would include criteria of greater sustainability.

Nowadays, organic products and sustainable brands are becoming increasingly popular and consumers are showing growing interest in a more environmentally friendly lifestyles, however, these attitudes are not being transferred to their purchasing decisions related to sustainable fashion (Vehmas et al., 2018).

The objective of this study is better understanding of consumer experience and specifically identification of the emotional components that determine decision-making process in the context of sustainable fashion. Characterization of the affective element and its integration into the causal models will provide the tools for brands and designers of sustainable fashion to help them understand the behaviour of their customers throughout the consumption experience better.

When consumers evaluate their consumption experiences they assess the objective attributes

(utilitarian) such as price and quality but also the subjective aspects (emotions), (Hume, 2008). Satisfaction clearly has an affective element and a cognitive component (Oliver, 1997). Therefore, the success of the exchange is closely related to the ability to evoke emotions and provoke subjective reactions (Addis and Holbrook, 2001).

During the last decades, the research of the emotional element and the development of conceptual frameworks explaining consumer responses has emerged as an area of growing interest (Havlena, Holbrook and Lehmann, 1989; Huang, 2001; Baker et al., 2002; Kim and Moon, 2009).

However, not a lot of research has been done in the domain of sustainable fashion from the consumer's perspective. That is the focus of this study, which analyses the consumption experience, particularly the affective component in the context of sustainable fashion.

Based on the adaptation of the S-O-R model by Mehrabian and Russell (1974), the model suggests that the stimulus (sustainable clothing) elicits an emotional state from the individual which, in turn, affects their behavioural responses.

Thus, the aim of this study is, first, to characterize the emotional component that happens in the consumption experience, based on the review of literature and the consensus reached, in order to conceptualize it. For that purpose, the most relevant definitions found in the research are analyzed. The emotion is then differentiated from other affective states that have been used in the research and the most frequently used perspectives in the analysis of emotion in the context of consumption are presented. Secondly,

from the perspective of the categories, the study aims to identify specific emotions that emerge in the consumption of sustainable fashion. Specific scale as a tool for the measurement of emotions within that context is to be constructed.

So the research questions are:

RQ1: What do we understand by emotion?

RQ2: Which specific emotions emerge in the consumption of sustainable fashion garments?

## EMOTION CHARACTERIZATION

In the study of emotion there is, currently, little consistency in the use of terminology related to emotions (Bagozzi et al, 1999). It should be noted that the contributions primarily come from the field of psychology (Richins, 1997) where there is currently a lack of definition, and even a consensual concept does not exist (Fernández-Abascal, Palmero and Martínez-Sánchez, 2002).

### DEFINITION

There is a wide variety of definitions owing to the fact that the process and emotional states are complex and can be analyzed from many points of view (Kleinginna and Kleinginna, 1981).

Fantino (1973) compiled a selection of eleven definitions and emphasized that different definitions reflected the diversity of aspects

researchers applied in the study of emotions. Plutchik (1980) listed twenty-eight definitions of emotion, concluding that there was little consistency or unanimity in the proposed definitions. He indicates that some definitions are underlining behavioural aspects, others use physiological terms and some are highlighting their disturbing or adaptive quality for the individual. On the other hand, Kleinginna and Kleinginna (1981) carried out detailed classification of one hundred and one definitions related to the concept of emotion. The list of ninety-two definitions and nine statements, which they called sceptics were classified into eleven categories based on the main emphasis of each definition. The work of these authors provides the most detailed classification to date (Plutchik, 2003; Palmero et al., 2006).

Based on the review of key studies (Table 1) we can define emotion as a) a process b) of a subjective nature c) that is elicited by a stimulus d) the evaluation of which e) produces changes and f) induces behaviour.

### OTHER EMOTIONAL PROCESSES

In the research of emotions the distinction between these and other mental states or processes has not been sufficiently clear (Kleinginna and Kleinginna, 1981; Bagozzi et al., 1999). Terms such as emotion, affection, motivation, mood or emotional state, feeling and attitude have been used indiscriminately.

Table 1. Definition of emotion

	<i>Kleinginna and Kleinginna (1981)</i>	<i>Reeve (1999)</i>	<i>Wallbott and Scherer (1989)</i>	<i>Lewis, Sullivan and Michalson (1990)</i>	<i>Bagozzi et al. (1999)</i>	<i>Fernández et al. (2002)</i>
<i>character</i>	affective experience	<b>subjective</b>		emotional states	mental state	episodic processes
<i>trigger</i>			situation	emotional inductors	acts o thoughts	<b>stimulus</b>
	cognitive process	biological	evaluation		<b>cognitive appraisal</b>	evaluation
<i>process</i>				emotional receptors		
		expressive	physiological changes	emotional expressions	physiological processes	<b>changes</b>
<i>reaction</i>				emotional experiences	affirmation	
	<b>behaviour</b>		motor expression			
<i>action</i>	psychological adjustments	functional	motivation to action			re-balance

Source: Based on the referenced works

According to Palmero et al. (2006) we can say that living beings possess a genetic endowment to show signs of an essential affective process that is to approach the pleasant and avoid the unpleasant. Emotion is an adaptive process that form part of affective processes; however although all emotions can be considered a form of affective process, not all affective processes are emotional processes.

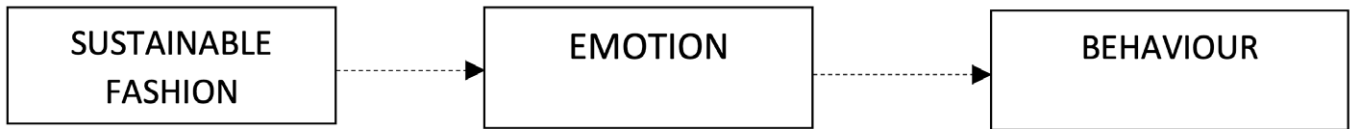
## APPROACHES TO EMOTION

Theoretical framework provided by Mehrabian and Russell (1974) with the stimulus-organism-response (SOR) model (Figure 1), maintains its conceptual validity for the application in different contexts with the purpose of to analysing the

behaviour of the consumer. The S-O-R chain suggests that a stimulus affects the emotional state of the subject (organism), which, in turn, produces a behavioural response.

Two major approaches in the study of emotions, within the consumption context, are: the perspective of categories (Batra and Holbrook, 1990; Alexandre, 2010); and the perspective of dimensions (Donovan and Rossiter, 1982; Fiore, Jin and Kim, 2005; Wirtz, Mattila and Tan, 2007; Kim and Moon, 2009; Kim and Lennon, 2010). The first approach groups emotions around a certain number of basic emotional categories (Huang 2001) while the second approach studies emotion in terms of underlying dimensions that characterize emotional states (Ha and Lennon, 2010). Identification of these specific emotions to the context of sustainable fashion is the second objective of this study.

Figure 1. Model of stimulus/emotion/behaviour



Source: Based on Mehrabian and Russell (1974)

### MEASUREMENT OF EMOTION IN THE CONSUMPTION

There are four major contributions, all from the field of psychology, used to measure emotion in the context of consumption: Izard's Theory of Differential Emotions (DES) (1977); Plutchik's Emotion Model (1980); the PAD model, by Mehrabian and Russell (1974) and the PANAS Theory, by Watson and Tellegen (1988) (Huang, 2001).

The scales are based on two approaches: the perspective of the categories and the perspective of the dimensions. This study focuses on the perspective of the categories; according to which, all emotions come from a relatively small number of basic emotional categories and emotions are considered to be discrete entities.

According to Richins (1997) these measurements ignore some of the emotions people experience and include certain terms that are not familiar to a large number of consumers while some terms are confusing. Apart from that some of the emotions that emerge from the analysis of interpersonal relationships may be different in intensity and quality, or not experienced during the consumption experience.

Considering these arguments and specific process of the experience of sustainable fashion consumption the development of a measurement scales for identifying the emotions operating in this particular context is deemed suitable.

Specific measurement scale is to be constructed. The development of the scale is based on the recommendations of Churchill (1979, 1981). The procedure begins with a bibliographic review that allows a large set of items to be generated, which is then refined with a discussion group. The final configured list is evaluated using a questionnaire that is submitted to a sample. The results will provide a set of emotional descriptors that sustainable fashion produces in the individual. Subsequent data analysis will enable the examination of its dimensionality - which categories of emotions the descriptors are grouped in - as well as its reliability and validity.

For this purpose, a questionnaire including ninety-five adjectives, which are the result of analyzing previous work, was prepared. Specifically, the list of descriptors was obtained from the works of: 1) Havlena and Holbrook (1986), - where twenty individuals describe eight consumption experiences examined based on the Plutchik's scale (1980); 2) Havlena, Holbrook and Lehman (1989), where a list of twenty-five emotional terms is obtained based on the frequency of use in one hundred and forty-nine consumption situations described; 3) Richins (1997) identifies sixteen clusters of emotions containing a total of forty-seven emotional descriptors from six consumption situations; 4) Thomson, MacInnis and Park (2005) compose a list of thirty-five adjectives they use to measure emotional attachment to brands and 5) Arora

and Singer (2006), who use a scale in catering services based on DES Izard II (1977). Finally, Roseman's contribution (1991) which states that the combination of five evaluations determines thirteen emotions was also considered. A total of one hundred and nine descriptors were extracted from these works. After eliminating the ones that were repeating and further subjecting them to the discussion group, a list of ninety-five items remained. The list of initial emotional descriptors that will enable the construction of the measurement scale is shown in Table 2.

## CONCLUSIONS

The work focuses on the analysis of the affective component that occurs in the consumption of sustainable clothing, towards which there is a growing favourable attitude that has not been converted into buying behaviour.

Based the conceptual model of Mehrabian and Russell (1974) it is proposed that sustainable clothing (stimulus) induces an emotional state (organism) that in turn causes a behaviour

(response). Emotion is defined as a subjective process that is elicited by stimulus; it is evaluated and results in changes and induces behaviour, It was characterized as well by differentiating it from other affective processes, used in researches, such as affection, feeling, mood and motivation.

Within that conceptual framework, the aim is to identify specific emotions, from the perspective of categories that occur in the consumption of sustainable clothing.

For that purpose the construction of a specific measurement scale is proposed as a subsequent research which would build upon the list of emotional descriptors obtained in this study. The scale would provide a better understanding of the emotions that emerge in the context of sustainable fashion, which would enable the analysis of the causal relationships between sustainable clothing (stimulus), emotion (organism) and consumption behaviour (response).

Table 2. Emotional adjectives

item		item		item		item	
P1	Passionate	P25	Uncomfortable	P49	Contented	P73	Afraid
P2	Attracted	P26	Embarrassed	P50	Confused	P74	Concentrating
P3	Energetic	P27	Disappointed	P51	Discontented	P75	Envious
P4	Irritated	P28	Nervous	P52	Guilty	P76	Happy
P5	Pleased	P29	Romantic	P53	Jealous	P77	Intimidated
P6	Enjoying	P30	Exhilarated	P54	Interested	P78	Distaste
P7	Disinterested	P31	Threatened	P55	Absorbed	P79	Sleepy
P8	Curious	P32	Peaceful	P56	Distant	P80	Ashamed
P9	Alert	P33	Encouraged	P57	Unpleasant	P81	Sentimental
P10	Angry	P34	Depressed	P58	Alerted	P82	Afraid
P11	Anticipatory	P35	Disgusted	P59	Attentive	P83	Calm
P12	Fearful	P36	Delighted	P60	Revulsion	P84	Amazed



P13	Bashful	P37	Terrified	P61	Astonish	P85	Hostile
P14	Surprised	P38	Miserable	P62	Bored	P86	Annoyed
P15	Quiet	P39	Joyful	P63	Relieved	P87	Frustrated
P16	Worried	P40	Entertained	P64	Sad	P88	Optimistic
P17	Horrificed	P41	Loving	P65	Indifferent	P89	Tense
P18	Anxious	P42	Impatient	P66	Satisfied	P90	Startled
P19	Scared	P43	Panicked	P67	Gloomy	P91	Helped
P20	Grief-stricken	P44	Lonely	P68	Humiliated	P92	Hopeful
P21	Melancholic	P45	Shy	P69	Excited	P93	Crying
P22	Trusting	P46	Accepted	P70	Offended	P94	Warm Hearted
P23	Proud	P47	In pain	P71	Fulfilled	P95	Eager
P24	Relaxed	P48	Puzzled	P72	Sexy		

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# Responses in urban and periurban horticulture: Social design interventions to promote sustainable consumption and production

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## Abstract

Today sustainability is about social action. Collectively the participation of people in local initiatives to manifest wellbeing and change is vital. The pursuit of the Sustainable Development Goals (UN, 2016), the increase of vegetarianism and veganism as a lifestyle (Jallinoja, Vinnari, & Niva, 2018) and the awareness of reducing waste (Hollander, Bakker, & Hultink, 2017) represent today ways of responsible consumption and circular production. Initiatives that promote organic farming, food services and allotments among the city have emerged recently as a megatrend. Though design education is possible to respond to this kind of initiatives which are promoters of glocal action. This paper is about bringing together social innovation, product design and sustainable horticulture. Here we describe the process of co-designing with a group of product design students together with urban and periurban horticulture initiatives. Each initiative presented a series of challenges related to consumption and production and were project hosts of various group of students. Each group designed a collaborative workshop to bring together citizens, volunteers and stakeholders of the initiatives. The output was to prototype products and services that generate sustainable behaviour towards horticultural practices. Beyond an academic exercise, the social innovation aspect observed in this study was the implementation of an effective social design format that uses a mix of design methods that according to the context promote co-design practice and behaviour change towards a circular economy.

## Keywords:

Horticulture, social innovation, sustainability, codesign



## 1. INTRODUCTION: SUSTAINABILITY AS A GOAL FOR SOCIAL INNOVATION

### 1.1 THE NEED FOR SOCIAL ACTION

The following research born from the need to link sustainability and social innovation within the area of industrial design. It also responds a call to encourage design students to become responsible in the way they engage sensibly within their locality and global efforts.

There is a need to ignite collective engagement. Social design have been in recent years making an effort to facilitate strategies for co-designing and at the same time promote sustainable action. Design has becoming a social process that involve many actors ; in its practice applies the approach of social reassembling in where key actors might differ on each stage of the process (Ekomadyo & Yuliar, 2015). This kind of inclusive innovation or co-designing process extends the work to solve the problem into a learning process for the society.

Precisely, sustainability is about social action. Collectively the participation of people and academia in local initiatives to manifest wellbeing and change is vital. Both sides empower participation, willing to create and solve. It also refers responsibility and transformation features that are present in every glocal sustainability initiative.

Design for sustainability has a high value for the citizen and academia. We seek for less degradation, less depletion of materials and more social equity (Wever & Vogtländer, 2014). As the culture of sustainability goals permeates together with design seeks to bring value in users,

environments, collectives, enterprises, services and related systems in order to bring prosperity. This research is focused in the way we look for sustainable food systems through co-designing.

### 1.2 GLOCAL HORTICULTURE AS KEY FOR RESPONSIBLE CONSUMPTION

Nowadays food production in and around cities seems unseen part of the urban fabric. Urban and peri-urban horticulture (UPH) plays an important role in diversifying urban diets and providing environmental services. It also seen as a therapeutic (Harris, 2017), educational and social tool.

Initiatives that promote organic farming, food services and allotments among the city have emerged recently as a megatrend (Davies & Bowman, 2016). Though design education is possible to respond to this kind of initiatives which are promoters of glocal action. Initiatives like Incredible Edible, Transition towns and food forest (McLain et al., 2012) are examples of localization movements that have gain global attention. Despite these movements born in urban locations, their impact is reaching big cities.

The pursuit of the Sustainable Development Goals (UN, 2016), the increase of vegetarianism and veganism as a lifestyle (Jallinoja, Vinnari, & Niva, 2018) and the awareness of reducing waste (Hollander, Bakker & Hultink, 2017) represent today ways of responsible consumption and circular production. These aspects become vital to generate resilience in an age of inequality and rapid depletion of resources.

The #12 UN Goal seeks to promote green industries, efficient resource management, clean production, energy efficiency in industry, waste reduction and pollution, and environmental sustainability policies in industrial production

and consumption as well as the circular economy approach.



Fig. 1. Family income alternative (Gobierno de Jalisco, 2015)

A way to generate social action is the implementation of horticulture which is a way to beat vulnerability and environmental crises. Since the World War II we realize that urban allotments and localized agricultural practices are key to maintain communities (Speak, Mizgajski & Borysiak, 2015). Nowadays governments and global organizations, like the FAO or UNIDO are key to generate this kind of social alternatives to move towards sustainability and human flourishing (See Figure 1.). In such movements and localized initiatives, academia often participates in order to generate research and use them as educational scenarios.

## 2. BETWEEN THE URBAN AND THE PERIURBAN: CODESIGNING AS A WAY FOR SUSTAINABLE HORTICULTURE

### 2.1 KEY DESIGN ACTORS AND KEY DESIGN PROBLEMS

The research context of this research was through the module “Design for Sustainability and Social

Innovation” offered at Tecnológico de Monterrey at the School of Architecture, Art and Design in the State of Jalisco, Mexico. This module is offered for the students for the last semester of their undergraduate studies.

At the end of the course the student is able to understand and visualize co-design as an integrative tool for generating changes in the transition towards a most sustainable society, emphasizing the sociocultural component. Another objective is to help them to implement collaborative methodologies that contemplate interdisciplinary work as a trigger for social innovation from and for the community, by identifying the real problem the generation of strategies that solve the problem.

In order to reach a solid result the brief was set with the following question: It is possible to bring together social innovation, product design and sustainable horticulture? Though this brief the process of co-designing implied the interrelationship of multiple variables but also people. One key aspect is to approach of problem of horticulture in within the urban and periurban organizations. Such organizations in this context face vulnerability because their capacity and their conformation. Some their practices are not yet regulated by government bodies or if regulated they need to produce to maintain. Nevertheless the social farming aspect (Gacia-Llorente et al., 2016) provide a big impact for the inhabitants that often volunteer, trade and generate cooperation.

As a way to approach this problem we seek to connect with three local initiatives:

1) Parque Agroecológico Zapopan (PAZ), a decentralized agro-educational urban space supported by the municipality of Zapopan, Jalisco. This park reaches the poor and wealthy neighborhoods around bringing courses,

allotment spaces and events for people of all ages.

2) Ecocentro Providencia (EP), a green house/ green space in the city center that was abandoned at the back of a municipal administrative offices. The space belongs to a federal organization, but depends of the municipal administration through Health Ministry of Mexico (Secretaria de Salud)

3) Entreflores Creative Community, a private peri-urban horticulture space focused on the production of vegetables and edible flowers for restaurants. They also offer educational visits, courses and volunteer experiences.

These initiatives have in common several features such as production of organic vegetables, work with people of all ages, receive volunteers and seek for the quality of life of citizens. These together with the students and volunteers that attend are the key actors of the project.

Tho complete the brief given was to prototype products and services that generate sustainable behaviour towards horticultural practices for the citizens. The group was conformed by twenty students, and then divided in groups of three or four in order to tackle design challenges that each initiative had. Each initiative presented a series of challenges related to consumption and production and were project hosts of two or three groups of students.

## 2.2 DESIGN METHOD

The methodology implied a mixed method scheme for a co-design process aiming to deliver a social innovation and sustainable practice. The following steps resulted:

### 1. Context immersion.

First ethnographic visits of the three initiatives.

Here the students were not in groups yet. The initiative presented their objectives, shown their facilities and directed a conversation together with the professor of the module.

### 2. Context Research and the SDG's.

On this visit the conversation was planned to discuss the #12 SDG goal and the impact within the city, the initiative mission and the value of design.

### 3. Ethnographic research in site.

After conforming teams a second ethnographic visit was planned further structuring directed questions. The aim was to obtain a list of needs, to then choose one that could reach the #12 SGD goal.

### 4. Collaborative workshop.

Back in the classroom the students had to design a collaborative workshop using design methods to produce ideas and prototypes with the leaders of initiatives and volunteers. The groups had to bring materials and document the workshop.

### 5. Creative stage.

Back in the classroom each group had to analyse the materials in order to begin the generation of ideas to solve the problems detected.

### 6. Participatory development of ideas.

A third visit was conducted to present the ideas and upgrade them with the opinion of volunteers and leaders. The aim was to identify the viability but also bring the participatory ingredient required to co-design.

### 7. Prototyping.

Through rendering, mock-ups and real scale prototypes the groups created the solutions.

### 8. Initiatives Review.

A final visit to demonstrate the usability and



viability was conducted and documented. The aim was to identify possible modifications.

#### 9. Implementation.

The following step was to implement the solution given with the help of people, institutions and resources that each initiative may have.

#### 10. Tracking.

A final step was left open. The aim is that the students become entrepreneurs by helping the initiatives to developed further or the initiatives connect the effort to make the project happen.

This process of co-design came with an effective result. Each group designed a collaborative workshop to bring together citizens, volunteers and stakeholders, and the central aspect to bring sustainability and wellbeing at the center. See figure 2.



Fig. 2. Students conducting participatory workshops (various authors, 2019)

### 3. REDEFINING THE ESSENTIAL: HORTICULTURE THROUGH DESIGN ACADEMIA, GOVERNMENT AND PRIVATE INITIATIVES

#### 3.1 RESULTS. THE POTENTIAL OF HORTICULTURE IN THE GLOCALITY

The design academy could adopt a posture to pursuit of a cosmopolitan localism and a systems level change (Irwin, 2015). From the

implementation and redefinition of products and services, to the design of participatory workshops, consulting and related activities to connect; design establishes its role as a bridge.

The benefits that horticulture brings to the urban populations becomes vital. As the government impulse policies to help communities, groups and institutions to promote this kind of social needs, the design academy is an important stakeholder that frames those needs.

The following projects resulted from this brief:

- **Solar Dehydrator.** Device to dehydrate fruits and vegetables based made of wood, wire and transparent bioplastic. It is based on the principle of hot air flowing chimney.
- **Edible Flowers Transportation System.** A box to maintain fresh edible flowers and transport them easily in a motorbike. Based on the ancient principle of clay fridges.
- **Rotary Hydroponics Rack.** A vertical horticulture system to save space inside green houses. Based on hydroponics systems and rotary verticality.
- **Ergonomic Broadfork.** A useful tool to air and loose the soil. Based on the principle of permaculture.
- **Mini-greenhouse for Seedlings.** System of trays that protects the seedlings from birds and insects. Uses a mesh and steams water. For small spaces to propagate seeds.
- **Compost Crusher.** Machine that helps to crush big chunks of organic waste to easily compost.
- **Growing didactic material.** Educational toolbox that helps students and people to know the distance to plant a seed and make an effective growing.

- Tree Propagation pot. A biodegradable resin pot that helps the root systems of trees to grow healthy and straight inside. (See Figure 3 for some examples)



Fig. 3. Sample of projects developed by co-designing: from the left, Rotary Hydroponics Rack, Tree propagation pot, Ergonomic Broadfork and Solar Dehydrator.



Fig. 4. Immersion and co-designing workshops (various authors, 2019)

## 4. CONCLUSIONS

Through this type of projects we can conclude that becomes easy when the efforts of academia, local initiatives, citizens and key global goals are set together. These are some of the conclusions that were revealed after concluding the project.

- Beyond an academic exercise, the social innovation aspect observed in this study was the implementation of an effective social design format.
- Mixed methods according to the context can help to promote co-design practice.
- Behaviour change towards a circular economy can be delivered by urban policies. The periurban factor can facilitate such models of change, and design can be a catalizer.
- The sensibilization towards urban and peri-urban horticulture is vital to maintain resilience, wellbeing and social collaboration (See figure 4).

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# Track

## Design for Culture

*Culture and design share a space of reified ambition. Design for culture extends the enquiry into the intention embedded in the programme of artefacts and communications, to the broader web of interactions in which they move. Design practice experienced over the last three decades a transition from a culture of service to one of self service (Axel et al, 2018). The resulting fragmentation of its remit into a series of highly localized spheres of action makes now the practice of design both successfully universal and semantically slippery. Every taxonomy of design disciplines is inevitably contextual and temporary. The semantic and symbolic values with which design is invested fluctuate while artefacts experience their life cycles. In the process, these things of material or immaterial design are actively inscribed with meaning, but they are also unwittingly imbued with records in a forensic fashion. As research on design trains its lens on the territory that lies between things and other things, as well as between things and people, this very in-between space reveals itself as a continuous environment of information waiting to be decoded. This panel invites contributions on themes including and not limited to: design and cultural industries; history of design cultures; design and information; design practice as facilitation in material and immaterial heritage; data cultures; memory between tradition and innovation.*

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# Experience of the printed object: (dis)connections between “Borda d’Água” and “Egoísta”

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## Abstract

Considering the possible configurations of communication in the design area, the visual aspect presents itself as a preponderant and systematically present factor in various contexts of contemporary life. The association of other valences from visual communication to printed editorial objects allows the user to induce new sensations and awake memories, provided by the artefacts, which contain elements capable of stimulating interest and curiosity, by comparing to other more conventional objects. The understanding of the relationship established between the reader and the printed object is constituted by the experience, which occurs mainly over visual stimulation, through emotional or intellectual reactions.

The scope of this study is to explore the relationship between a ‘common’ editorial publication by intertwining it with a specific kind of interaction of magazine, exploring the visual and tactile connections between the user and the artefact. Hence, one can recognize the importance of the design for culture.

At the same time, this study seeks to understand two different editorial genres and their visual culture through the lens of design. Therefore, the evolution of editorial design in the Portuguese panorama was circumscribed to magazines and almanacs (about thirty publications analyzed). This step was based on the search and analysis of counterparts publications to “Borda d’Água” almanac and “Egoísta” magazine, both Portuguese periodical publications. In this process, publications that revealed innovative situations in layouts and interactions were selected. At the same time were found examples within the combination of experiences: at the level of visualization and interaction between contents, and content with the user. The results obtained from the layout of editorial artefacts intend to illustrate several potentials of the culture of design and culture for design, these being representative of possible solutions to include in the creative process of design and for design. Thus, it is intended to contribute to an intimate relationship between the existing content and the form associated with experience, conferring a new graphic proposal to the editorial object and, consequently, seek to achieve a degree of symbolism associated with a greater sensorial experience.

## Keywords:

Experience, Senses, Editorial Design, Magazines and Almanacs, Layout

## 1. THE CONTEXT OF AN EDITORIAL ARTEFACT THROUGH CULTURE, AS AN EXPERIENCEABLE OBJECT

The connection between communication and culture translates into the design of relevant artefacts in different areas of study, expanding mainly through graphic design. Communication in its visual aspect is intelligible and defining of graphic design, capable of stimulating the reader's interest and curiosity, in a parallelism between conventional artefacts and others with bolder elements, in a sequence of emotional or intellectual reactions.

In the context of the history of Portuguese design and in the sense of the appreciation of its culture, artefacts which acquire a communicative and sensory value are distinguished, and are characteristic of a valuable graphic intervention. The dynamism developed between the artefact and the reader establishes different results that vary with graphic communication, ensuring several symbolic values to the object, at the level of experience, memory and desire.

The layout process of an artefact intends to display the potential of the culture of design and culture for design, included in a creative process of design and for design. Likewise, the exercise of design should provide expression and personality to content, in order to attract readers and keep them interested, in a clearly structured publication.

As editorial publications, each "can entertain, inform, instruct, communicate, educate, or be a combination of these things" (Caldwell & Zappaterra, 2014), comprehending different formats.

Thereby, the design process is only conceivable due to the progression in graphic resources, such as the constant evolution of printing processes, machine industrialization, and updates in digital

programs that can simplify layout and editing of contents. Hence, editorial artefacts enclose features of consonant representations with a certain period, from an aesthetic point of view.

## 2. RELEVANT PRINTED OBJECTS FROM A PORTUGUESE BACKGROUND, FROM THE 15TH CENTURY TO THE 21ST CENTURY

The collection of significant editorial objects within the historical context of Portugal and its culture is elucidative of the transversely of publications. This research seeks the exponentiation of sensorial experience, in the reading or consultation of editorial publications, allowing the development of a new dynamic link in the artefact-user duo. The main references to this study were two periodical publications, considering "Borda d'Água" almanac (1929-) and "Egoísta" magazine (2000-), which lead this approach to a catalog of publications. Consequently, the present investigation was based on the study of a total of more than thirty publications, being eleven almanacs and twenty-two magazines. The chronological sequence of artefacts begins in the 15th century and continues to the present time, describing the evolution of production and design in the editorial industry, from a Portuguese culture prospect.

### 2.1 ALMANACS

In the Portuguese context, the analyzed samples of almanacs occur in sporadic publications, arising mostly from the 19th century in a variety of strands, preserving in its content some characterizing elements of this literary genre. All editorial artefacts considered are based on calendars, complemented with data on tides and stars with relevant festivities and holidays



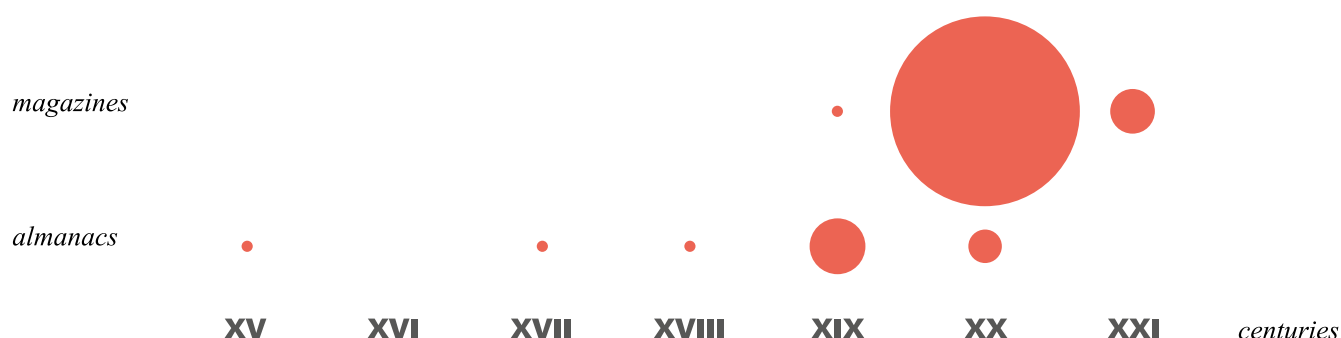


Fig. 1. Comparative dispersion of the number of publications (magazines and almanacs) over a chronological timeline (from the 14th century to the 21st century). From the author's archive.

dates. Thus, almanacs were a preferable source of information for those who did not have easy access to other publications, helping them to prepare their agricultural activities, so they would not be negatively affected in their main source of income and subsistence, by predicted weather changes. Moreover, these publications may also refer other subjects, such as information about the country or the world, short stories and other literary works, suggesting its importance in culture.

In the middle of the 15th century, Abraão Zacuto drafted the **Almanach Perpetuum**, written in 1473 but printed in 1496 (Albuquerque, 1994). The almanac only had data that could be interpreted to each year, through the tables and calculations included, to obtain results for later years<sup>1</sup> (Manuel, 2010).

During the 17th century, **Almanach Prototypo e Exemplar de Pronosticos** is published in 1645, containing illustrative engravings (of stars and seasons) and other figures associated with text organization. The following publications from the 18th and 19th centuries often denote religious and political references, being the monarchy and revolution central topics of chronicles, presented for example in **Kalendario Romano** (dated from 1708), **Almanak Democrático** (dated from 1852) and **Almanach do Trinta** (dated from 1880). The almanac **O Seringador** was first published in 1865<sup>2</sup>, describing itself as a critical and jocular

repertoire. The significant increase in the number of published almanacs throughout the 19th century illustrates the interest about this editorial genre. New publications are the result of the broadness of audiences, considering personal beliefs and social interests, triggering the increase in cultural premises, confirmed by the **Almanac Encyclopedico** (1876) and the **Almanac Bertrand**<sup>4</sup> (1900).

Thus, a literary approach to these publications is highlighted, considering the prominence of Portuguese authors, such as Eça de Queirós<sup>3</sup>, and the promotion of other artefacts, as in **Almanac Bertrand**<sup>4</sup>.

During the 20th century, political changes are, once again, revisited, and almanacs corroborate its relevance as an archive of events. The introduction of **Almanach da Republica** occurs in parallel in two country districts, Lisboa (1911) and Coimbra (1913), both featuring contents with an historical and describing character. In 1929, **Borda d'Água** was published for the first time, denoting to be a "report useful to everyone". This almanac depicts only the characteristic information of this editorial genre, and its graphic aspect has not changed in the last ninety years<sup>5</sup>.

<sup>1</sup> Zacuto's astronomical studies allowed him to also craft a metal astrolabe (an ob-ject used in vessels to measure the height of the stars above the horizon line). This combined with the tables from the almanac were essential to the Portuguese discover-ies (Albuquerque, 1994, Vol II, p.1091-1092).

<sup>2</sup> This almanac is still being published in the present year, 2019.

<sup>3</sup> Eça de Queirós wrote the preface of *Almanaque Encyclopedico*.

<sup>4</sup> *Almanac Bertrand* is a publication edited by Livraria Bertrand, a Portuguese bookstore.

<sup>5</sup> *Borda d'Água* is still published annually, counting ninety editions in 2019.

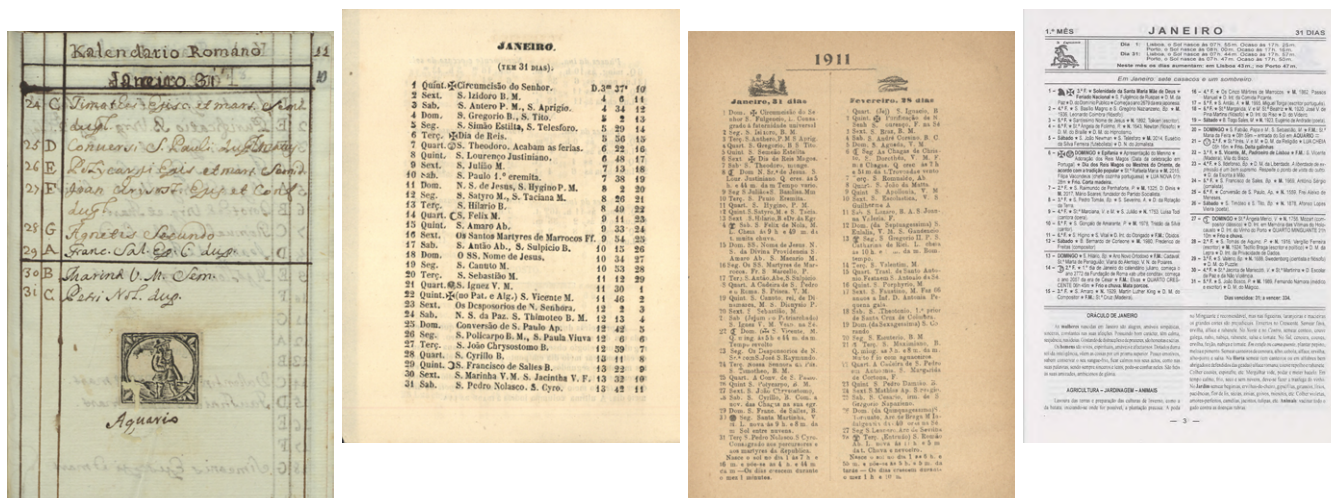


Fig. 2. An example of similarities between almanacs from different periods – the pages selected from each almanac depict how the monthly calendar is illustrated (represented in these examples is the month January, from distinctive decades). From left to right: Kalendario romano (page 9, from 1708); Almanak Democrático (page 14, from 1852); Almanach da Republica (Lisboa edition) (page 3, from 1911); Borda d'Água (page 3, from 2019). Source: Biblioteca Nacional de Portugal catalogue, contents available online.

## 2.2 MAGAZINES

The inauguration of the 20th century heads a new cycle in the Portuguese artistic panorama, guided by the introduction of new systems for printing and reproducing graphic content<sup>6</sup>, merged with new interests and responses to popular needs. The combination of this with the evolution of the education system, ensued in ideal conditions for development in the editorial outlook. The first publications analyzed<sup>7</sup> have their argument in common, presenting themselves as a combination of literary transcripts and illustration, picturing a distorted reality through parody and caricatures, portraying the Portuguese social prospect. While in this period the regency of an institutional monarchy was evident, the political changes of the 10's also pushed into innovation artistic movements. Therefore, the introduction of modernist models<sup>8</sup> in Portugal is verified in the following years, emphasized through the

publication of **Orpheu** (1915) and **Portugal Futurista** (1917).

During the 1920s, illustration stood out in magazines, although dissociated from the humoristic aspect from previous publications, conferring a distinct graphic aspect. Moreover, these new publications embody a varied thematic range, comprehending matters as art, sports and politics, aiming at social integration in current topics – as it shows in publications as **ABC** (1920), **Contemporânea** (1922), **Ilustração** (1926) and **Presença**<sup>9</sup> (1927). Furthermore, other audiences are considered, introducing magazines subordinated to cinema and others addressed to women, as **Eva** (1925) and **Voga** (1927) (França, 1991).

The 1930s introduced Portugal to a new political reality, with the implementation of a dictatorial system. Considering the positioning of this structure, Secretariado de Propaganda Nacional (SPN), in 1933, was created to answer the artists' individual and social needs for the nation. From

6 Such as Linotype and Monotype machines, or the introduction of lithography printing or offset.

7 A Paródia (1900), Paródia: Comédia portuguesa (1903), Ilustração Portuguesa (1903) and Papagaio Real (1914).

8 In its pages stands out the intention to provoke literary and visual sensations, through typographic exploration in a formal rupture with grammatical syntax.

9 This magazine used the Futura typeface, remarking its audacity.

this commitment between design and the regime, **Panorama** magazines arises in 1941, dedicated to the promotion of tourism, fine arts and decorative arts, and promotion of artistic and ethnographic heritage.

In a different way, **Vértice** emerges in Coimbra, in 1942, as a cultural magazine in the resistance to the ruling dictatorship. The intense control of publications by censorship contributed to the ignorance of the population on everyday issues in an impoverished country. Thus, only in 1959 appears another publication of graphic interest: the **Almanaque** magazine. This artefact translates into the parallel editorial genres with the same designation, almanacs, and its content also does the same<sup>10</sup>.

The gradually increasing superior training in design, especially during the 1980s, regenerates the approach on the designing of graphic design, promoting visual communication. This, along with the constant introduction of publications alluding to dissimilar topics, results in different visual outcomes, as displayed, for example, in **Blitz**<sup>11</sup> (1984) or **Revista K**<sup>12</sup> (1990). Furthermore, the introduction of computers to designers allowed them to explore layouts through new perspectives, instigating experimentation with typefaces or grids, enhancing the interest in graphic representations (Fragoso, 2009). Since the beginning of the 21st century, a set of new publications were introduced, combining a variety of topics in the same edition. The magazines considered in this study from this period are **Egoísta** (2000), **Umbigo** (2002), **Pli** (2011), **Gerador** (2014) and **Observador** (2017). These publications diverge in visual appearance, all of them having different purposes. **Egoísta** and **Umbigo** are presented as “objects of worship”, while **Gerador** uses a tone of proximity and casualness with the reader; **Observador** displays lifestyle contents whereas **Pli** is a magazine published by ESAD<sup>13</sup>.

## 2.3 COMPARATIVE ANALYSIS OF ARTEFACTS

Regarding this chronological timeline of publications, it is possible to understand the connections between the contents and the period artefacts are located in. Going through the pages of almanacs, it is possible to understand the consistency in the analyzed ones, having similarities both in their content and the graphic aspect<sup>14</sup>. Concerning to magazines, particularly during the 20th century, the impact of printed publications is evidenced, denoting them as catalogues of the progression of historical evolution.

Thus, in both sets of publications, printed artefacts record social, political or other events of a given era, designed accordingly to the influences of distinct artistic movements, corresponding to the period they were placed in.

**Conventional Publications.** Nevertheless, printed artefacts do not have to be just the container of information. There are features that when used can turn artefacts into more desirable objects, through the introduction of unexpected elements. These components can be intertwined within the printing support, involving the message amongst the form, capturing the user’s attention (Hurlburt, 1986). Therefore, these differentiating factors combined with the composition of the other available graphic options, such as typography, color, layout, or its organization in the support, stimulate the user’s willingness to continue consulting through the final object.

10 Almanaque intended to cross the conventional contents in almanacs with art and culture, with illustrations, in a framework of social satire.

11 Blitz is a magazine subordinated to culture and music.

12 Revista K uses Bodoni and Futura as typefaces.

13 Escola Superior de Arte e Design: a university in Portugal focused on teaching art and design.

14 Tables and calendars appear in a similar way, from the 15th century till the 21st century. The number of pages is the aspect that fluctuates the most, having more or less pages, and consequently affecting their binding.

The act of flipping a printout does not necessarily have to be confined solely to the systematic reaction of moving the hand and advancing to the next page in order to complete the consultation of its content, in those that are characterized by conventional publications. The promotion of user interaction and experience is a differentiator point amongst the editorial objects available in the context of production of artefacts of this nature.

**Experience and Interaction.** The designing process must take into consideration the user, and include human-centered design (HCD) principles so that the final object concerns a deeper knowledge about these symbolic values. From this perspective, the association of a psychological analysis and technology constitute the method to achieve what is considered as “good design” (Norman, 2013). Human needs, capabilities and behaviors are taken into consideration, leading to singular final products, allowing a universe of distinct relationships and experiences between the artefact and the user. On the other hand, when objects are “badly designed”, they can lead to frustration and disgust (Norman, 2013). Thus, user perception is a basic aspect of communication that relates directly to experience (Hurlburt, 1986). Consequently, the emphasis that previously relied on the reader and writer, is now attributed to the user – with a different connotation established by a set of needs and restrictions, of a cognitive, physical or emotional character (Lupton, 2006). This process only occurs after visual stimuli induce emotions or intellectual reactions (Hurlburt, 1986), depending on the user’s interaction with sensory experience. Therefore, the five senses can contribute to interest and empathy in the user, and, in the graphic design activity, sensations are the consequence of methods and technologies used in the composition of the final artefact – from printing and ink, to the grammage (weight) of the paper and binding.

Sight, smell, taste, hearing and touch all have their purpose in the experience. For example, even when the user reads a conventional publication, he sees its graphic appeal, smells the paper and ink, hears the pages turning and feels the paper in his fingers. However, the user’s relationship with the object can also be reinforced by the use of associations with previous moments and memories, which attributes new meanings to the artefacts through sensory stimuli and resonances (Sudjic, 2010).

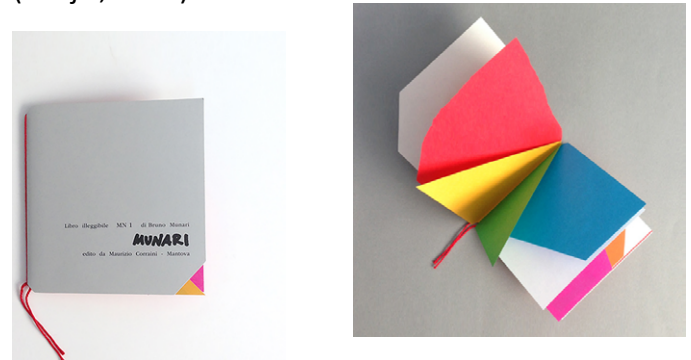


Fig. 3. An example of how interaction and form can override content: “Libri Illeggibile” by Bruno Munari. A 10x10cm book without text, where pages have different colors and shapes. The reader has nothing to read, only to experience – going through pages and revealing the individuality of each spread. Source: Moon Picnic Homepage, <https://moonpicnic.com/product/libro-illeggibile/>, last accessed 2019/12/16.

### 3. “EGOÍSTA” MAGAZINE: A ‘CATALOG’ OF POSSIBLE EXPERIENCES

Some elements can turn the artefact into something more desirable or with a different graphic visual interest. The introduction of unexpected elements, such as cut-outs or detachable pages, for example, can accentuate a certain message in a printed page. Egoísta magazine is an example of how unpredicted components attract an audience to read and keep buying a publication. Moreover, people end up expecting the unexpected. The first time a reader



browses through one edition of this magazine, becomes surprised of how connected these elements can be to the theme of said number. The reaction after finishing reading, is to look for another edition, and go across the pages searching for more of these elements. For this study, it was crucial to browse through all the Egoísta editions, in order to understand those referred elements, how they flow in one edition, and the repetition in the course of the almost twenty years<sup>15</sup> of publication. The directory obtained from this study is not broad, but its categories comprehend a wide range of solutions. Therefore, these elements are mainly a consequence of the support used, or a result of any process made on that support. Hence, texture and color of the support occur parallelly to sizing and format of the pages<sup>16</sup>. After choosing the most appropriate support for the artefact, other techniques can be applied, as a result of the introduction of methods of production and machinery. Thus, under a manual activity or an industrial process, some things can be implemented, resulting in a differentiated production of a non-conventional publication. As a result, inserts, folding pages and detachable elements are found throughout, and comply the user to interact with the artefact. Consequently, this disconnection of parts from the main object results in the creation of a new supplement, and can have diverse purposes. As for the cut-outs, these can be just on a page or in a combination of pages. Although the cut-outs found on the artefacts analyzed are, apparently, different, the total amount of pieces available to employ is not that wide. However, the possible combinations available and different positions on the layout result in diverse outcomes. Moreover, to finish the publication it is mandatory to bind each one, and this process also constitutes a universe of possibilities. At the end, each method applied during the entire development (from designing to printing and finishings) of

an artefact contributes to the uniqueness of a publication, and this individuality is what mainly compiles the scoop of this investigation. Egoísta ends up being a distinct magazine, and the cataloged design elements emphasize the contents displayed in each edition.

#### 4. “BORDA D’ÁGUA” ALMANAC AND ITS SCARCITY OF SENSORY INTEREST

Borda d’Água has been preserving its visual aspect, and to the present day is still sold just folded, and without any other aggregation system of pages. However, this acts as an authenticity mechanism<sup>17</sup>, and it is also one of the components enhancing sensations. In fact, this forces the user to cut (or tear) the folds of pages<sup>18</sup>, stimulating tactile and hearing sensations. This method transfers a certain ability to the user, enabling a sense of decision and singularity imposed in the artefact.

From an aesthetic point of view, some inconsistencies are found throughout the twenty-four pages. Although the layout is maintained, mutability between contents is notorious. However, the grid is simple, using two columns and the same gutter and margins. As for the typography selected, two typefaces are used: one serif and other sans-serif, completed with different weights (roman, bold, italic, expanded and condensed, or even a combination of those). This amalgamation of dissimilar weights results in a lack of hierarchy of data, concealed with fillets and frames delimitating different levels of information. Other typographic characteristics observed are the disparities of body size in different pages, and leading and tracking adjusted

15 The first edition is dated from 2000.

16 As a result of trimming to the required appearance.

17 Copies of Borda d’Água were sold, but some abnormalities allowed users to differentiate the original from the replica.

18 On the right and top margins, so that information is accessible.

to the amount of words per page, so that information can fit in the designated space. With a detailed analysis of the almanac, it is possible to perceive certain elements that, for a common reader, are not so palpable. Thus, it is denoted the intention to simplify the search for information and, in a general context, this almanac is useful for its purpose. Nevertheless, the exploration of this publication exposes the lack of interest from a visual communication perspective, demonstrating the absence of significant sensory experiences.

How (dis)connected can these artefacts be? The investigation emerged under the premise of a historical and formal analysis of editorial publications, of the selected typologies, by electing two diametrically opposed examples, being the same distinct for the target audience, for their visual communication and representativeness in terms of the number of printed copies. In this sense, the conscient use of Borda d'Água almanac and Egoísta magazine resulted in the analysis of unconventional elements in their 'use' (associated, for example, to the act of flipping pages, smelling or interacting). The informative character of the almanac outcomes from the low-cost production, where the repetition of a few elements stems from profitability of a production system aiming a finalized editorial object. On the other hand, Egoísta magazine is abundantly complete in the experience extent, with a more complex production process. During concept and design stages, layout and introductory elements are carefully designed, in order to highlight a certain part of a page or a message. This method allows the strategy to change accordingly to the theme of each edition, in a thoughtfully projected artefact. Thus, this study concludes that, although Borda d'Água in its current form responds to its purpose, it is possible to transpose it through a graphic design process, to an object promoting memories and sensory experience, suitable for a differentiated target audience. The disconnection between the two genres occurs mainly in the contents, and the visual communication and sensorial capacities can be stimulated as long as the graphic and cultural aspects are valued through a design process.



Fig. 4. Cover (first page) of Borda d'Água almanac, 2019 edition. This annual publication maintains its contents and layout similar since the first edition (1929). Source: Borda d'Água, digitalized from Sara Dantas' archive.

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# Art in Videogames

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## Abstract

This long paper is structured in such a way that it initiates an approach on the definition of art so that it is then possible to point out how video games can be introduced in that context with the application of the most contemporary aspects of art. However, this type of interactive digital artifice requires a foundation that relates video games as an object of artistic creation and allows the player to contemplate and enjoy this type of digital artifice. For this purpose, the Theory of Clusters is portrayed, in which it presents characteristics that define the attribution of an object as a work of art, that is, how the design of video games can relate and be associated in the field of work of art. Based on the context and concepts portrayed, examples of video games are pointed out in order to explain how visual design and artistic language can be applied and function from the perspective of the world of video games.

## Keywords:

**Art, Video Games, Artistic Creation, Visual design.**

## 1. INTRODUCTION

The complexity that the concept of art currently presents in contemporary society has been considered as a subject of considerable controversy in the sense of use, way of thinking and formulating distinct opinions relatively on how to attribute the status of artistic and aesthetic object in everything that suffers, or receives alterations, from a human action.

The liberation of the norms used to create the aesthetic object, with the appearance of the ready-made, led to different methods of artistic and technological creation, which use and relate to the art side and which have been emerging since the 20th century, being looked at differently in terms of the understanding, experience and way of thinking of each individual.

Commercial video games are interactive digital artifacts introduced from the middle of the century. In addition to the use of technologies for their development, they seek to use various and different artistic forms in order to create a kind of communication between the author of the work and the player within the virtualized and imagined world. However, the discrepancy existing in contemporary society leads to the need to create theories on how to make an object enjoy the status of an artistic and aesthetic object, that is, theories like the Clusters' Theory of the philosopher Dennis Dutton that seek to create an approach and characteristics in the sense of being able to consider and relate an object as an art object.

The present and constant evolution in the world of video games has been demonstrating their development capacities and how they are increasingly coming closer to creating a graphic language, visual design, managing to provide

the player with aesthetic satisfaction or pleasure through simulated, effective and possible immersion in the virtual world that can be found in different genres of video games, whether more commercial, artistic or with a great emphasis in terms of referring to artistic movements as a basic concept.

## 2. ART

### 2.1 A LOOK AT THE ART WORLD

Considered as an activity that is manifested since the beginning of mankind, art, whose term comes from the Latin "Ars", being interpreted as a technique and/or skill, is understood as a manifestation of an aesthetic order that seeks to stimulate a form of thought, for those who observe this form of activity, through the representation of the use, on the part of the resulting action of man, of cognitive processes, sensations and ideas, processes that serve to transmit expressiveness and venusty to the imagined and demonstrated world. Regarding the concept of art, Argan defends that *"The concept of art therefore does not define categories of things, but a type of value. This is always linked to human work and its techniques and indicates the result of a relationship between a mental activity and an operational activity"*. (Argan, 1994: 14)

This form of activity is conceptualized as a movement that has been evolving into a plural language where aesthetic manifestations of different fields and sensibilities have been introduced within this form of artistic expression. Art is heterogeneous and unstable, since it is through the ages and socio-cultural nuances that aesthetics of the literary, musical, theatrical, plastic, photographic, cinematographic genre

are built and reconstructed, as well as artistic orientations that emerged during the 60s of the 20th century where technology is combined and used for the development of artistic work, such as the artistic manifestation called Land Art, or through the use of communication technologies that give the image an important influence by specifying artistic forms of expression such as Video Art, virtual art and cyberperformance.

No matter how much one takes into consideration that the etymological sense of the word determines its origin and meaning, art can be defined as a movement that has varied under the view of the human being over time and depending on the different cultures spread around the world, leading to a lack of consensus on what can really define this type of activity in a more coherent way, that is, a concept about what art is.

*“The phenomenal field of art is difficult to delimit: chronologically, it comprises manifestations that go from the most remote prehistory to the present day; geographically, all inhabited areas of the human community, whatever their degree of cultural development. Artistic activities are considered very different from each other: not only the so-called visual arts, (...), but also poetry, music, dance, spectacle, gardening”. (Argan, 1994: 13)*

In a general way, art is interpreted as an activity that the human being performs with the purpose of expressing feelings and emotions, through the representation of reality through his own imagination and perspective regarding who performs this type of function, regardless of age, ethnicity and sex, which can be reflected through the culture and history in which we are inserted, because art becomes a cultural construction that varies over the years not being able to acquire a unique and consistent interpretation.

Even if this definition has not gained a deep-seated form, the object, used for this function, or the artist himself, seeks to represent a form of communication similar to linguistics, so that the aesthetic object contemplated by the spectator is examined, not only in its physical dimension, but also in its significant dimension. This method of seeking to communicate, to convey a certain meaning and/or sensation, is applied to different types of aspects *“Whether through an architectural work, a film, a song, a theatrical work, a photograph or a painting, the artist seeks to communicate.”* (Carita, 2012: 3)

This type of communicative function, among the various artistic aspects, tries to reflect particularities of the artist's perspectives, human, value and emotional, through the use of decipherable codes for those who interact with the aesthetic object. However, the application of codes in the practice of aesthetic observation, may result in a completely different or contrary recognition of the characteristics proposed and/or understood by the author in his own work.

Notwithstanding this form of communication and interpretation towards the aesthetic object contemplated, aesthetic values such as beauty, balance and harmony are corresponding as elements of visual design in which they are taken into account so that art is expressed, building an effective communication that has the purpose of awakening and stimulating interest, imagination, sensations and emotions, a meaning or feeling on the part of the spectator. This genre of expressive representation can be accomplished by the intervention of various existing art forms, taking into account that these activities linked to the world of art only began to take shape during the 18th century in Europe with the manifestation of the concept of Fine Arts such as, and taking into account a numbering currently more consensual, music, theater, painting, sculpture, architecture,

literature and cinema. This last element of artistic expression is defined as the seventh art through the *"Manifesto of the Seven Arts"* published in 1923 by the theorist and film critic Ricciotto Canudo. This plastic art is defined as an activity or movement that, besides having come to enjoy the status of art by reaching its technical and aesthetic maturity when presenting audiovisual narratives, it unites different artistic forms into one, as well as being increasingly introduced as a key element in the development of commercial video games.

## 2.2 A QUESTION ABOUT THE ART OBJECT

The constant evolution that art has been acquiring, as a form of communication, technique and skill, under the vision of the human being demonstrates a development that, with the passage of time, has resulted in several changes at the aesthetic and communicative level, however, this evolution leads art to vary its definition not acquiring a single and consistent interpretation, however, this development, during the twentieth century, reaches a completely different level in relation to the previous artistic movement beginning to raise numerous doubts about this type of activity, that is, what can or cannot be considered something as an object of artistic nature.

This kind of questioning arises by the philosophers themselves through exhibitions that began to emerge questioning the concept of beauty, a concept introduced by the civilization of Ancient Greece and supported by the philosophers around the seventh century. This aesthetic concept called beauty, as far as artistic activity is concerned, is looked at in a more questioned and interested way through the Greek philosopher and mathematician Plato, an author who tried to look for a way in which art could be distinguished from other objects. According to this philosopher,

this distinction was produced through mimetic representation, that is, mimesis, a term that *"consisted on the object's ability to achieve similarity or represent something else. Using the philosopher's expression can be equated to pointing a mirror at something else."* (Reis, 2017: 37).

This form of representation, even though it had some gaps concerning its requirements for this type of reproduction, it was imperative that for the object to be considered a work of art, its reproduction should be an imitation, as Noel Carroll defines it: *"x is an artwork only if it is an imitation."* (Carroll, 1992: 21)

Beyond this type of rhetorical thought through a mirrored representation, an imitation, the human being sought, throughout various types of artistic movements, to represent the concept of beauty, a concept introduced through a set of pre-established rules and values called canons, in order to realize what was considered art. Even if the use and application of the canons began to emerge during the time of the art of Ancient Egypt, where the imposition of this set of rules can be considered as the creation of a style of its own, it is during the period of Ancient Greece where the properties relating to the canons are more related and approach a purpose allusive to the creation of an artistic work through the application of the concept of beauty and the representation of realistic works, that is, *"The goals of art were to seek Beauty and Universal Harmony, concepts supported by philosophy."* (Carvalho, 2008: 19)

This conception has developed over the course of several centuries while maintaining the essence that art itself represents and symbolizes, however, it is during the early twentieth century that this imposition of the canons is broken through a proclaimed manifestation of Ready-made, a

manifestation effected with exhibitions such as “Fountain” by Marcel Duchamp and “Brillo Boxes” by Andy Warhol, a representation idealized through common objects that are part of our daily lives, products of an industrial nature, as artistic pieces. This artistic operation led to a devaluation of the notions considered common to the history of art as a style or production of what was considered an artistic work, that is, *“The passage of time has obviously changed the ways of forming/representing: we have seen an evolution, which has passed through the imposition of canons until the progressive liberation of norms”*. (Oak, 2008: 10)

This way of being able to develop today what can be considered as art demonstrates that, the liberation and removal of norms / rules to create an object of artistic nature, can be developed in different ways, however, this way of thinking and creating an object of art leads there is a discrepancy present in the contemporary world of art and in the various activities related to it, as can be remarkable, this divergence in terms of thought and observation on the part of the human being, in relation to the digital and interactive world of video games.

### 3. VIDEO GAMES AND THEIR CORRELATION WITH THEORIES ALLUDING TO THE ART OBJECT

#### 3.1 CLUSTERS THEORY

Considering the adversities that the Ready-made manifestation developed, it resulted in the origin of a divergence, currently present in contemporary society, creating this different and varied viewpoints and thoughts on how to consider an object as an artistic work, a question that is still present today in the aspect of video

games on whether or not they are framed as objects of art.

The video game, considered as the 10th form of art, numbered after photography and comics, is a digital artifice initially created with the objective of involving a playful interaction with the user. Seen as a global phenomenon that has been growing in a colossal way, currently counting on eight generations of consoles since 1972 with the initial launch of Magnavox Odyssey until the generation of the use of virtual reality and the growth of competition from new products such as smartphones, tablets and gaming computers, as well as the growing existing gaming community that arrived, according to a report exposed in 2015 by Newzoo, approximately 1.91 billion players (Santos, 2016: 35-42), video games have been built from the use of various art forms such as music/sound, design, narrative writing, cinema and/or animation, among others through the use and technical manipulation of software technologies, thus being developed today in a context of increasing complexity, since the creation of virtualized worlds, the narrative and its historical context and the concept itself, thus integrating elements from other art forms prior to this, as well as the 11th art form considered as digital art, an art form that encompasses 2D and 3D art and programming languages produced within a computational graphic environment.

The application that this type of interactive digital artifice presents in relation to the various art forms does not necessarily make video games an artistic object, for this reason, it becomes necessary to explore how it can be linked to the art pattern through a better analysis of the relationship between the art world and video game design. Therefore, even with a diversified and inexact interpretation of the definition of art, it is possible to find, for example, theories that provide us with a better approach to be able to

define how the virtualized world of video games can be seen as an artistic work.

There are several theories that exist and mention characteristics in the sense that an object can be classified as a work of art being taken into consideration the Theories of Clusters, theories mentioned by Grand Tavinor who states that *“Cluster theories of art claim that art can be characterized by a set of conditions which an object might meet in any numbers of ways.”* (Tavinor, 2009: 177) The Theories of Clusters is a theory that aims at the anti essentialism of art that, even presenting certain gaps and issues associated with the quantity necessary for an object to meet the requirements to be considered as a work of art, provide a good approach in order to define how the design of a video game can be considered and linked to the pattern of art following and constituting a set of criteria as property having the advantage, in the same way, in the sense that the object does not have as an obligation to possess the totality of this set of characteristics. Within these characteristics of the Theory of Clusters, the American philosopher of art Dennis Dutton, an author referred to by Grand Tavinor in the book *“The Art of Videogames”* (2009), in which he listed a set of criteria that take into consideration the attribution of an object as an artistic work:

*“Dutton’s (2006) list of characteristics features shows a substantial overlap with Gaut’s, by including direct pleasure, the display of skill or virtuosity, style novelty and creativity, criticism, representation, “special” focus, expressive individuality, emotional saturation, intellectual challenge, traditions and institutions and imaginative experience”* (Tavinor, 2009: 177)

These points exposed regarding the Theory of Clusters, in the vision of the American philosopher Dennis Dutton, are presented as a

set of characteristics that show that they can not only be directed in relation to what involves the world of art, but can also end up creating a connection regarding the world of visual design of video games. Relating these characteristics of the Theory of Clusters to the world of video games, in total nine criteria are pointed out according to this art philosopher, such as direct pleasure, a condition approached with the intention of creating pleasure through a video game that should be issued to the user on an aesthetic level. As in any video game, besides its graphic/visual representation, its development goes through a composition of several different areas, such as digital art, design, writing, among other elements present and equally important for its construction, becoming a characteristic applied in any video game and referring to skill and virtuosity. The representation of the virtual world is another criterion exposed in which it portrays this same virtualized world as something true, that is, credible, connecting spontaneously to the imaginative experience allowing the participants, those who interact with this type of digital artifacts, to explore the narrative worlds and props in order to attract the player himself. Another equally important referenced element is the intellectual challenge, a feature applied with the aim of challenging the player in terms of interaction with the character, the controller, that is, the experience that the game itself can offer the player. The following aspect to consider is innovation and creativity, as the name indicates, is a characteristic exposed and used with the sense of representing the virtual world as realistic as possible, however, not only looks for this form of representation, because it also aims to evolve more and more its graphics. In the days that occur, video games are seen as part of popular culture and, even gaining an institutional acceptance does not mean that they are allied to the world of arts, but, and according to Tavinor, the world of games. This importance



must be taken into account that it must be related to critical analysis, a criterion that is exposed and that eventually correlates to the marketing of ads. Another characteristic point that the philosopher Dutton emphasizes is the special focus, an aspect that is directed to the involvement, better said, to the immersion that a video game must be able to provoke to the participant who interacts with this type of interactive digital artifices. Being able to be present in any or all types of video game design and presented as the last mentioned characteristic according to Dutton regarding the Theory of Clusters, individual expression aims at transmitting the imaginative vision, originality and the very character of the creator who is involved

in the commercial development and visual and artistic design of video games. All of these mentioned and justified characteristics are perceptible, or most of them, in video games like *"Shadow of the Colossus"* (Ueda, F. & Ōtani, K., 2018), one of the most acclaimed video games of all times and considered as a masterpiece. Developed by SCE Japan Studio and published by Sony Interactive Entertainment Europe, this video game, initially released for the Playstation 2 console and recently published for the recent generation of the Playstation 4, has undergone two remasterings presenting an improvement in graphics and a more optimized performance.



Fig. 1. Moodboard *"Shadow of the Colossus"*

The remastering of this work presents us with a vast, beautiful world of enormous graphic detail and a mysterious environment that strongly characterizes the concept of this one, involving the presence of an emotional expressiveness by the extensive and silent environment, which is explored through the freedom offered to the player, and the empathy present in the main character and his horse as well as in the Colossus, the enemies of the game. Taking into account the complexity for the development of this video game as well as the points described that characterize and represent this great production, this work ends up becoming a good example regarding the necessary criteria mentioned by the art philosopher Dennis Dutton.

The introduction of this philosopher's theory becomes an important reference in the sense that the characteristics can be seen as those that can best define the attribution of an object as an artistic work, even though the mentions of these properties create gaps and questions that this very theory raises, that is, the analysis and mention of the characteristics of the Theory of Clusters make visible the ability to be named and a better understanding of a video game be analyzed as an artistic work, however, due to the questions that this very theory raises, they end up making this value judgment as a more difficult task. Starting from the principle, already referred to, that art corresponds as a function or movement performed by the human being with the purpose of reproducing, through his own imagetic vision, his interpretation of reality, adding the need to express different kinds of sensations for those who interact with this type of activity, it is possible to perceive that, in a certain way, some points of the Clusters' Theory of the American philosopher Dennis Dutton manage to have a similar relationship with video games, as is also evidenced by the painter Henry Matisse in the sense that painting "(...) serves the artist to

*express his outside visions."* (Hess, 2001: 71)

### 3.2 ARTISTIC VIDEO GAMES

Assuming that the artistic universe has not only been evolving but has also been inserted into society, the video game being part of contemporary culture can also be worked on, in addition to its more commercial constituent, having a greater focus on the development of the artistic component. This type of visual design applied to the art of video games is called Gamearts, that is, artistic games that aim to find a way to offer the player a sophisticated aesthetic enjoyment through its graphics, the poetry that exists between video games and their concept, the emotions that the sound component provokes us and the symbolism that the backgrounds can provide us without creating an anxiety with the common concepts of victory and defeat, evident in commercially dominated video games. Reinforcing the idea of developing and representing the design of artistic games, Mendonça maintains that the method of creating an artistic game becomes similar to the development of a commercial game, yet has greater influence: *"...by the exploratory focus on the conception and transmutation of the idea into artistic expression... the main deferential between a gameart work and a commercial game is made by the existence of artistic and poetic expression, making the piece critical and/or reflexive in relation to platforms, genres and/or modes of commercial games"*. (Mendonça, 2014: 73)

Other examples of video games that can be considered fundamental here due to the care in which visual design blends with the visual sensibility of the arts are works such as Flow (Thatgamecompany, 2006), Flower (Thatgamecompany, 2009) and Journey (2012).





Fig. 2. "Flow"; "Flower"; "Journey"

These types of video games become like good examples allusive to the basic concept of an artistic video game, in which they present a set of criteria already mentioned, a narrative world that aims to explore the symbology of their backgrounds or landscapes, the emotion that soundtracks provoke us, as well as seek to create an interactivity with this type of video games. All this composition of features seek to present a work of interactive art.

The concept and development of Gamearts, having a better foundation on the concepts approached between the world of arts and video games, can be called into question because this type of interactive digital artifice is designed as a way to provoke a greater number of emotions instead of creating a goal where the generalized concepts of victory and defeat are inserted, that is, the objectives that these artistic video games aim to represent, achieve or attempt to approach the form of contemplation required by works of an artistic nature, resulting in a differentiation from video games of a more commercial scope, however, it is not possible to consider Gamearts only and solely as elements of art than as a video game itself.

However, it is also possible to find games that make it possible to have a connection between the graphic design elements present in artistic games and the variety of mechanical components used and implemented within the more commercial video games, without losing their

identity, that is, the attraction that the graphic component of artistic games and the various components used and put into practice to develop video games give us, in the example of the game Okami (Kamiya, 2006), an action/adventure video game published by Japanese game developer and publisher Capcom, which presents us with a "cartoon-like" graphic aspect, which goes back to Japanese paintings thanks to its traces of varied thicknesses, vibrant and strong colors and blurs, elements that harmonize with the plot and the implemented mechanics, end up showing that it becomes possible to have a connection between both concepts, art and video games, without the produced video game itself losing its own identity.



Fig. 3 - Okami

### 3.3 ARTISTIC MOVEMENTS AS BASE CONCEPT

In addition to the characteristics that artistic

games can comprehend, it is possible to come across video games that, even with the existing questions about this type of digital artifice being seen as art or video game, end up using works or styles of artistic movements from the real world as the focal point or as the main reference for their development and concept of this same, either in a more direct or indirect way. Nowadays, more and more examples are beginning to be found that have been made with this kind of reference, being a good part developed from the first decade of the 21st century. *Blow* (2008), *Limbo* (Playdead, 2010) and *Mirror's Edge* (Trudgen, J. & Sommerbakk, V., 2008) are examples of interactive digital artifacts where the reference linked to the world of arts does not go unnoticed. The approach and relationship that this type of video games present with painting are seen as cases of great success due to the relationship between these two types of concept. *Braid* and *Limbo* demonstrate their ability to graphically express their ideals and references through the representation of their backgrounds, the use of colors and traces, as well as *"seek to rely, fundamentally, on the concepts of dream or nightmare, like many of the paintings that define Surrealism..."* (Carita, 2013: 7)

Developed by EA Digital Illusions CE in 2008, *Mirror's Edge*, a work that already finds a reboot with its recent launch in 2016 for different types of platforms, becomes a distinct case in relation to the examples mentioned, that is,

*"The city of Mirror's Edge is clean and white as a canvas, allowing the primary colours, as*

*an autonomous medium, to acquire a greater visual strength, thus putting itself in evidence. Art is expressed through relationships that, both in Mirror's Edge and in Piet Mondrian's compositions, are based on pure primary colours (blue, red and yellow), shapes, forces and dynamics".* (Carita, 2013: 5)

This distinction is not only notorious for the dispersed implementation of elements of abstraction painting within a more realistic virtual world, as well as the representation of a background and minimalist elements in order to reinforce the importance of the colors and forms implemented, that is, this pictorial use is employed as a way to lead and assist the player to the goal imposed within the video game.

This form of graphic representation of movements is not conditioned exclusively in this way when it is possible to refer to allusive languages to their component and artistic and aesthetic expressiveness, providing Vaporwave as an example. A genre that emerged at the beginning of the 21st century, Vaporwave is an example of an art style that originates from digital cultural manifestations and has an enormous range of handling and ways of developing this genre that is disseminated mainly by Internet users through the sharing of this type of concept. If interactivity is seen as the main element when it comes to the ludic video component, this activity of a particularly musical and artistic nature does justice to the characteristics mentioned, as in indie video games called *"Vaporwave Aesthetic Simulator Tycoon"* and *"Outdrive"* (DNVR Prod, 2016) or even *"Data Wing"* by the game designer Dan Vogt.

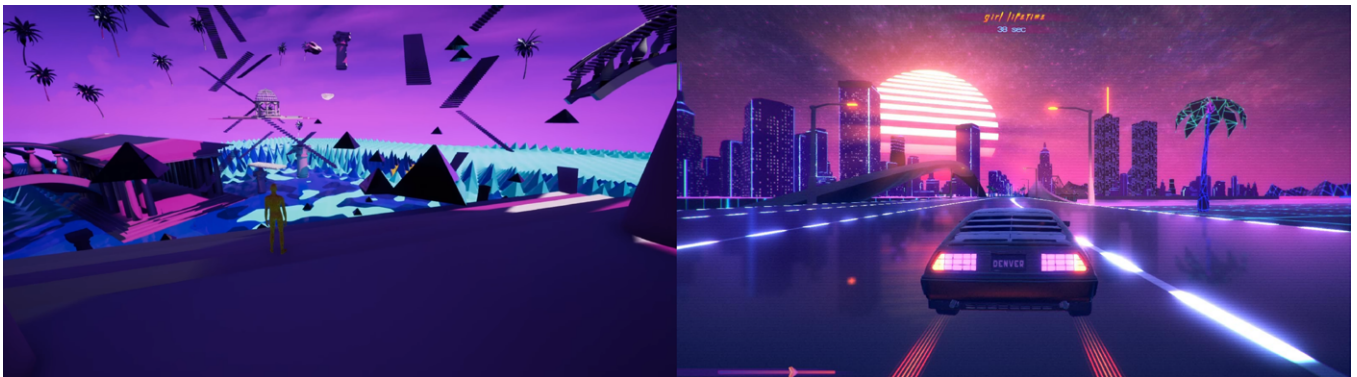


Fig. 4 – "Vaporwave Aesthetic Simulator Tycoon" and "Outdrive"

These examples of interactive digital archetypes become reference models for the application of freedom and development of the digital aspect as well as for the design, aesthetic and artistic part, in the same way, the iconic representations of the particular components of this movement, portray an aesthetic complexity relative to virtualized environments, composed, in general, by palm trees and statues, among other representative elements, and by a set of lights corresponding to tones of pink and blue that can result in feelings of nostalgia for the type of time or objects symbolized.

## CONCLUSION

These notions and characteristics portrayed, from the constituent of the arts to the playful and artistic component of video games, demonstrate and manage to reinforce how these two elements have been relating and interconnecting, however this relationship can be equally subjective both on the part of video games as of all art. To this end, all this connection requires, on the part of those interacting with this type of interactive digital artifice, a need for knowledge on both a cultural and artistic level, resulting in a better understanding of the analogy present between art and the world of video games. However, nowadays, it is unthinkable to escape

from the fact that the homogenization between the various media involving electronic technology, information, communication, among others, and the plastic or traditional, visual and applied arts are increasingly strong to the point that these two models (technology and art) are used together, commonly and professionally, in the form of creation and expression of technical and artistic works, in a society where thanks to the evolution of the media, such as photography, computer, cinema and video, elements that are connected to the industry and development of digital games, there is an unconditional freedom of interaction with technical and scientific models, software and components at artistic levels, even if there is no concern about its internal functioning and technical forms of reproduction developing, in that way, a diversification of content, languages and experiments, being plausible to refer as an example the artistic movement Vaporwave. Thus it becomes possible to evaluate the situation where technology and art meet, any user has the freedom and power of creation, imagination and development of works as well as interact with other alternative means, in a world where rapid technological advances do not allow the human being to mature on a certain industrial, artistic and software object and that is why philosophy, like the aforementioned Theory of Clusters, can not provide perfect or specific data and synthesis

on the issue of art in video games, however it is composed of a base that becomes at the same time strong and reference for future philosophical analysis of these same concepts, however nothing becomes an impediment when it is notable and that there is a use of greater autonomy and interactivity on the part of Internet users or the population itself in general who understand a figurative role and power of interaction of immense possibilities.

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# Portuguese cultural identity in the urban cultural context of Fashion Design

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## Abstract

This work aims to address the relationship between fashion and Portuguese cultural identity in the urban cultural context. Fashion represents a moment in the history of societies, the culture and reflects important social influences (Roselle, 1980). The writer Oscar Wilde wrote that, according to his life's philosophy: "only foolish people do not judge others by their appearance, [for] that the true mystery of the world is in the visible and not the invisible" (Wilde, 1890). At the same time, Louboutin says: "Portuguese fashion is not yet under pressure from the international machine, which allows a certain creative freedom that is well evident in the work of some creators. I think, however, that there is a lack of identity in the Portuguese fashion" (Louboutin, 2011). The French footwear designer encounters the genesis of this research that seeks to understand if there is a need for national fashion to have an "identity", knowing that this term can mean its recognition at an international level. Perhaps it would be more correct to say that a "tradition" or even a "culture" is in fact a reflection of contemporary times, of the era of globalization, determining the importance of the links between a culture of fashion and the places/cities/countries to which (see Gilbert, 2000), see the case of the wine sector, one of the examples of the construction of a "cultural tradition" in Portuguese society. This research, about cultural identity and fashion, intend to analyze to what extent, the symbolic character present in a culture can have a functional dimension without losing its meaning. The search for an identification through the objects of fashion (clothing, accessories, footwear) can be interpreted by the consumer, regardless of the productive origin of the same. It should also be noted that this perception on the part of the consumer is also interconnected with the internal and external "image" of a given country, an "image" that expresses an idea of quality and productivity in a certain segment that is transmitted globally inside and outside it (Roth and Romeo, 1992). Thus, in order to answer and reach the proposed goals, a bibliographical review was made on the global sociological framework and the characteristics of the Portuguese fashion. We used a non-interventionist methodology and developed. A case study and

data collection with structured interviews with fashion designers and opinion makers are made. The results and discussion were analyzed, concluding the question of identity, central to the construction of society, however, it is not reflected as a concern on the part of the national fashion designers. If on the other hand some authors argue that culture is the starting point of an essential concept to perceive the true meaning of consumer behavior, associated with the personality of a society, on the other, the choices of the same consumer is not dissociated from the cultural contextualization context in which they were assimilated.

**Keywords:****Cultural Identity, Fashion****REFERENCES**

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# Fashion Design as a Contemporary Cultural Object

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## Abstract

This article aims to analyze fashion design as producer of cultural objects. Through design culture can be 'consumed' embodied in products (Carvalho & Centeno, 2010). With this focus, we proceeded to study fashion in its cultural component, in the context of globalization and postmodernity, as contemporary phenomena. Fashion, as a contemporary cultural object, is beyond the aesthetic issue of dress. It is able to interpret social representations in the urban environment through the daily habits, lifestyles, behaviors, consumption and symbology present in clothing. It is influenced and interferes with urban transformations, together with socio-political, economic and cultural dynamics, establishing typical patterns of historical moments. With globalization and cross-cultural influences, the dynamics are rapid and interrelated, changing the meanings of urban cultural codes as well as individual consumption practices. In the face of constantly changing contemporary contexts, fashion needs to create distinctive strategies to meet the new demands of consumers, based on studies that identify their tastes and preferences, from which designers develop products that dialogue with the profile and identity aspects of fashion consumers (Massarotto, 2008). The competition among products and fashion brands confront the market with new design perspectives that include the rescue of old techniques in which the hand-made dominates. This orientation goes in the reverse direction of the technological development but can also be associated with it in the production of fashion items that can also become objects of desire. The value given to the product by fashion design is associated with the value that brings to it the cultural meaning, and the distinctive symbols in which the local culture and the craftsman's knowledge intersect. The way of building, the techniques of doing, the emotional investment are part of the identity of the territories (Bulcão, 2017). Culture contributes to fashion design, and stimulates designers to outline strategies for the production of competitive goods in the market supported by a strong cultural identity. However, when designing fashion items with these characteristics, the designer needs to have a thorough knowledge of local history and culture, and to understand that these products will represent the rewritten culture and identity as well they will their own aesthetic perspective. This is a delicate work, which implies a social commitment to rescue and reintegrate cultural aspects of a people, while creating products that generate desire for ownership in a dynamic, competitive and technological market (Bulcão, 2017). This strategy can enable fashion designers to launch new market brands in which profitability is associated with social and economic sustainability, preventing traditional skills from disappearing over time.

**Keywords:** Globalization, Local culture, Cultural identity, Fashion design

# From literary research to collaborative practice: what is creativity in the Book of Disquiet Archive?

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## Abstract

This paper aims to discuss how a design approach, based on its creative capacity and “hands-on” features, has been significant in the development of participative Digital Humanities investigations, especially considering, in so many of these cases, specific literacies that have enlarged the gap between academic projects and the public in general. For that matter, I present here the case of two DH projects that are strictly correlated: the Book of Disquiet Archive (Portela, Rito Silva, 2017, [ldod.uc.pt](http://ldod.uc.pt)) and the Fragments in Practice (Magalhães, 2019-2021). The first one is an innovative digital critical edition based on Fernando Pessoa’s fragmentary work, *The Book of Disquiet*. This platform has an innovative Web 2.0 configuration: it has been designed to simulate literary practices on-screen by enrolling the registered users as new readers, editors and writers of these fragments. The second one is my current doctoral project, set with an ethnographic and participatory approach. My research has been complementary to the Book of Disquiet Archive authors’ machinic viewpoint, although I have been investigating the potentialities of the platform from another perspective. I am focused on understanding how users’ creative practices and their distinct backgrounds and practical circumstances can provide inventive discourses by using the platform. Even, *Fragments in Practice* has been conceived following a projectual view, in a way to set a better communication channel with the users. For this, it has been developed a supportive transmediatic structure, including didactic video tutorials, social media, discussion groups and different models of workshops. From the archive to the creative practice, this panorama can be initially related to three specific parts of these projects, which sets a complex nexus of investigative and practical activities in their intersection: 1) the granular representation of Fernando Pessoa’s creative writing process and his editors’ interpretative work, in the form of the digitised facsimiles of the *Book of Disquiet* as well as the transcriptions of the four critical editions of the *Book*, structurally arranged within the platform; 2) the Archive’s Web 2.0 interactive tools, based on the simulation of editing and writing practices, promoting different functional paths to visualise, compare and manipulate the original fragments; and finally 3) the productive ecologies of practice, mediated here within the presential and online *Fragments in Practice* workshops. These activities are opportunities to explore and test the theoretical and technical proposal of the archive, as well as to register the perspectives and insights of the users, most of them affiliated to investigative, educational and artistic fields in Humanities. This presented nexus brings creativity

as a material process that produces meaning, considering the mediatic and discursive features of the platform as well as the dynamics of the social and collaborative activities around it. In this sense, the idea of creativity here is expanded. On the one hand, the Book of Disquiet Archive is a representative project of a creative practice performed in what I have called a “discourse of practice”. In this sense, creativity is related to machinic programmed functionalities that instantiate users as creative agents, according to the archive’s pre-determined roles. On the other hand, in the Fragments in Practice project, creative practice is performed in a “practice of discourse”. Creativity here is related to the users’ interpretative and practical acts: their agency confronts, tests and designs, under different circumstances, the platform usage according to their own intended role.

**Keywords:**

**Book of Disquiet Archive, Fragments in Practice, Creativity, Digital Humanities, Design**

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# Track

## Design for Product Use and Experience

*Understanding product experience has become an important fact in product design. Designers are not only focusing on use and aesthetics of a product but also experience and emotions. In this sense, this track considers theoretical, practical and/or case studies papers that present some of the following topics: Design thinking, design philosophy, and design process; evaluation/comparison of methods and techniques of UX; qualitative and quantitative measurement and evaluation of usage and UX; international standards in usability, accessibility & UX; new methods and innovative ways to present results of user surveys; cross-cultural products, emotional design.*

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# Evaluating the impact of Plain Language on the comprehensibility of e-gov texts

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## Abstract

Digitization of the public sector has downsized assistance centers and call centers. Citizens have to process their requests and access public services on the Internet, without any human interaction. Considering that the vast majority of the Brazilian population has low levels of literacy and that personal assistance to solve doubts is limited, complex texts could be a barrier to e-government (e-gov) interaction. The writing style typical of the public sector, known as *officialese*, employs complex linguistic elements that make reading difficult even for advanced readers. The international Plain Language community has long addressed the issue of *officialese* in public communication, advocating for e-gov texts be as clear as possible. Interest in Plain Language has increased in the Brazilian public sector. However, its impact on textual comprehensibility has not been previously tested. The present research aims to evaluate the impact of Plain Language on the comprehensibility of an e-service at the National Institute for Social Security (INSS) website. This paper focuses on context, purpose, research questions and hypothesis, methodology, partial results, and next steps of the ongoing research.

## Keywords:

**Plain Language; Textual Comprehensibility; E-Government; Officialese; Information Design**

## INTRODUCTION

The digital transformation of the public sector is moving fast worldwide. New processes of delivering online public services (e-services) and providing access to rights have led to several outcomes.

On the one hand, electronic government (e-gov) has promoted transparency, stimulated social control, and called for accountability of public institutions (OECD, 2018). It has encouraged anti-corruption behavior, as individuals and companies can access online services on their own, without intermediaries. Digitization has stimulated citizen participation in a wide range of e-government platforms available 24 hours a day, seven days a week. Digital strategies also deliver significant financial gain for the public sector, given that online transactions cost up to 50 times less than face-to-face services (United Nations, 2018). In the UK, savings have been estimated to be between £1.7 and £1.8 billion per year (GOV.UK, 2012). In Brazil, e-gov transactions can generate savings of up to 97% (Brasil, 2018, p.95). Hence, it has become critical to facilitate access to digital public services.

On the other hand, digitization has changed the way people interact with the state in potentially harmful ways. It has created barriers that deepen social inequality and widen the digital divide, a far-reaching problem that transcends technology. The digital divide mostly affects vulnerable groups, particularly those with low education (United Nations, 2018). The United Nations [UN] advises that digital governance should meet the tenets of the 2030 Agenda for Sustainable Development and “leave no one behind” (ibid, p.27). The UN has listed thirteen barriers to interaction with e-government that worsen the digital divide, such as gender, age, disability,

education, and practical usage, and have encouraged social actors to identify more barriers and add them to the list (ibid,p.34).

The writing style typical of the public sector, known as *officialese*, can be considered a barrier to e-gov interaction. It employs complex elements that make reading difficult even for advanced readers, such as long sentences, passive voice, nominalizations, and jargon (Silveira, 2008; Mendonça, 1987), making it difficult for citizens to access information. Psycholinguistics literature shows that these elements alone require high costs of mental processing, hindering the comprehension even of those with top reading skills. *Officialese* tends to have several complex elements in the same sentence. If mental processing costs are high even for proficient readers, less skilled individuals find it even more difficult. Given this scenario, one can assume that the bureaucratic writing style widens the digital divide.

This paper gives an overview of research currently conducted in the master’s program in Design at the Pontifical Catholic University of Rio de Janeiro. The research summons concepts of Information Design, Ergonomics, and Psycholinguistics to discuss the writing style of e-government texts. The linguistic elements of those texts make public information challenging to read and understand, hindering access to services and rights. Thus, the research is related to the debate on barriers to interaction in e-government.

The present paper focuses on context, purpose, research questions and hypothesis, methodology, partial results, and next steps of the ongoing research.

## CONTEXT

Digital governance has been pushing citizens to process their requests and access public services on the Internet, without any human interaction. Brazil is one of the countries where e-gov policies prioritize online self-service (Brasil, 2016). The federal administration has put much effort into digitizing public services, especially in the last few years. This endeavor is giving results: Brazil currently holds the 44th position in the UN E-Gov Development Index (United Nations, 2018), up from 51st in the previous survey.

Citizen service centers and call centers have been downsized or no longer exist. Therefore Brazilians are driven to e-gov platforms to access and process most services – this means reading through all texts related to the service to find the information they need. In such a context, it is paramount to take into consideration the low levels of literacy and reading skills of the Brazilian population (Inaf Brasil, 2018):

- **8%** are unable to read and write (**illiterate**);
- **12%** can find one or more explicit information, expressed literally, in straightforward texts like calendars, simple tables and informative posters (**rudimentary level**);
- **34%** can select one or more units of information, observing certain conditions, in diverse texts of medium length, performing small inferences (**elementary level**);
- **25%** can find literally expressed information in either journalistic or scientific texts, performing small inferences (**intermediate level**);
- **12%** can understand documents of greater complexity based on elements of a given context and can provide an opinion on the positioning or style of the author (**proficiency level**)

Considering that the majority of the Brazilian population struggles to read complex information and that personal assistance to solve doubts concerning e-services is limited, e-government texts should be as clear and objective as possible. Brazilian legislation requires government information to be presented in easy-to-understand language but states no guidelines (Brasil, 2011). Furthermore, facilitating the use of e-services is a priority of the Brazilian Strategy for Digital Transformation (Brasil, 2018). However, public authorities seem to disregard such pressing context for clarity, and *officialese* continues in use in e-gov writing, especially in services that cater to the most vulnerable such as those provided by the National Institute for Social Security–INSS (Fischer et al., 2019).

Texts that are challenging to understand can create barriers to interaction with e-Government and increase the digital divide, preventing millions of Brazilians from accessing services and rights. Therefore it can be inferred that difficult-to-read texts undermine citizenship.

The international Plain Language community has long addressed the issue of *officialese* in public communication (Chase, 1953; Gowers, 1988). Plain Language is a social movement that advocates the right to understand written information, and it is also a technique for writing easy-to-read texts (Fischer, 2018; Cutts, 2013). As a movement, it has a long history of facilitating access to information in several countries, mainly in English-speaking countries, and more recently also in Latin American countries, especially Colombia, Chile, and Argentina.

As a writing technique, Plain Language aims to universal accessibility. The goal is to elaborate easy-to-read texts for different levels of literacy. Over time, stakeholders interested in written

information to be more comfortable to read – citizens, consumers, civil servants, teachers, journalists, even lawyers – have consolidated several guidelines, empirically. The guidelines are primarily informed by practice with little support from linguists and scientific research.

With the digital transformation of governments, Plain Language has been adopted in e-gov in at least five countries: United States of America (Plainlanguage.gov, (n.d)), Great Britain (GOV. UK, 2019), Canada (Government of Canada, (n.d), Australia (Australian Government, (n.d.); and New Zealand (New Zealand Government, n.d.). The set of guidelines used in these five countries present similarities.

The Plain Language movement is less well known in Brazil, but interest has increased substantially in the last three years in the context of e-government (Fundação Seade, 2016; Gespública, 2016; Fischer, 2018). The São Paulo City Hall has just launched a municipal Plain Language Program (São Paulo, 2019), and many Government Innovation Labs throughout Brazil have begun to apply this writing technique to simplify documents. These initiatives mainly follow the Colombian Plain Language guidelines (Colombia, 2015) as there is no official set of guidelines in Brazilian Portuguese that have been scientifically tested.

## RATIONALE

International researchers have been urging the development of a scientific basis for Plain Language guidelines (Schrivier, 2017; Garwood, 2014; Schriver & Gordon, 2010) and a recent study by the Inter-American Development Bank recommends assessing the role of linguistic elements in the simplification of government texts according to Plain Language guidelines (Cuesta,

Reyes & Roseth, 2019).

Previous Brazilian studies that addressed Plain Language in e-gov texts did not focus on linguistic elements nor tested guidelines (Martins, S. & Filgueiras, L., 2007; Barboza, E. M. F. & Nunes, E. M. de A, 2007; Barboza, E. M. F., 2010).

## PURPOSE

The ongoing research intends to evaluate the impact of Plain Language on the comprehensibility of a Brazilian e-service at the National Institute for Social Security (INSS) website. The main goals of the study are:

- Assess the role of writing style in the comprehensibility of information about digital public services;
- Examine how Plain Language guidelines figure in international and Brazilian e-gov policies;
- Examine the linguistic structure of a text in the benefits section of the INSS website and see how it impacts comprehensibility;
- Assess the impact of Plain Language on the textual comprehensibility for the benefit of the INSS, considering the role of linguistic elements;
- Evaluate users' perception of the INSS text before and after the Plain Language intervention;
- Evaluate the perception of the writing style as a facilitating factor in accessing e-service.

## RESEARCH QUESTIONS AND HYPOTHESIS

The research questions are: How do users perceive texts about digital public services? To what extent does the writing style impact the comprehensibility of texts about e-services? To

what extent does the writing facilitate access to e-services?

We hypothesize that the text written in Plain Language will reduce doubts regarding how to request the INSS benefit.

## METHODOLOGY

The mixed-methods investigation is of exploratory and descriptive nature. The qualitative phase, involving documental research and literature review, attempted to understand the way in which government digitization processes have impacted how documents are written to citizens. It searched for studies on interaction with e-gov, public value, and digital inclusion policies to verify whether they have been discussing information comprehensibility on online platforms. This first phase also raised data on the Plain Language movement and its use in public communication in foreign countries, with emphasis on e-government.

In the following phase, a quantitative experiment will evaluate the impact of Plain Language on the textual comprehensibility of an e-service. The experiment aims to evaluate the impact of a Plain Language intervention on the understanding of information about an INSS benefit by highly educated users. The experiment will be composed of a group exposed to the intervention and a control group. The subjects will be asked to read the text and answer comprehension questions. We will assess text comprehensibility by measurement of information retention, reading time, and task completion. We will also measure user satisfaction with a satisfaction assessment scale.

## PARTIAL RESULTS

Documental research and literature review have evidenced that textual comprehensibility is a new theme in e-Government studies. Several researchers have investigated the ease of use of digital services, but have not focused on the writing style of information. Neither have researchers interested in digital divide issues. Similarly, Plain Language studies do not address issues of understanding related to digital government platforms. It seems there is a gap to be filled, as the interaction with e-Government depends mostly on the self-processing of textual information. Such texts tend to be written in *officialese*, a style that employs complex linguistic elements that compromise the understanding of information even by highly educated users.

We carried out an exploratory analysis of the linguistic elements of 19 benefit texts available on the INSS website. We found a pattern of recurrence of complex elements and intend to design the Plain Language intervention to address them. We have categorized Plain Language guidelines used in international and local e-Government in a matrix and will refer to them to rewrite the text of the INSS benefit evaluated in the experiment.

## NEXT STEPS

Semi-structured interviews with users will be conducted. The e-service text will be rewritten according to the Plain Language Reference Matrix. The new version will be validated through an experiment that will be designed, tested, and applied.

The findings of this research have the potential to cooperate with the body of scientific knowledge of writing in Plain Language, contributing with evidence to the fields of Design, Language

Studies, Public Management, Communication,  
Law and other areas interested in textual  
comprehensibility.

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# Interactive Spatio-temporal Visualization: Assisting the Design Process

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## Abstract

Spatio-temporal (ST) information visualization allows the user to observe, interpret, and acknowledge the occurrences or evolution of events, and locate them in both time and space. When interactive, ST visualization provides the exploration, discovery, and analysis of complex information in many different application areas.

The complexity inherent to visually represent both variables in an interactive system leads to a scarce number of these objects. For more frequent and satisfactory use of interactive ST visualization, it is a prerequisite to recognize what requirements, factors, and dimensions integrate an efficient graphical interface.

The designer's task is to translate both project-specific and generalized expert information into a language understood by users. In the specific context of designing interactive ST visualization tools, six main areas of expert information were identified: communication purpose, spatial components, temporal components, usability practices, the storytelling structure, and technical concerns. The designer would have to virtually master all of them to accomplish an optimal final result.

Towards the goal of better assisting the designer in the creation of such complex visualizations, we propose an iterative, multidisciplinary and author-centered process, that subsequently later supports user-centered ideation and design. This exploratory paper compares the process for the translation of interactive ST visualization components into design decisions, with the process behind the creation of theoretical tools developed to assist the design process.

## Keywords:

**Information visualization, spatio-temporal, interactivity, design process, design research.**

## INTRODUCTION

Information visualization is one area of reference in information design that covers the graphical representation of information in complex communicational contexts. When we think of information visualization, different genres and types of data may be suggested, such as charts, diagrams, games, maps, interactive infographics, videos, and animation, to name a few (Figueiras, 2013). One of the most complex but compelling kinds of visualization translates simultaneously temporal change and spacial location. Data containing both dimensions time and space can be found in diverse domains including mobility, dispersion, proliferation, and diffusion (Meirelles, 2013). The strong potential of Spatio-temporal (ST) visualization relies on a vast amount of possible application areas, such as educational tools, traffic flow analysis, understanding of climate change, observation of migration flows, social sciences, among others. Throughout the conducted research it was apprehended that the complexity of dealing with such complex datasets and the implicit need for various expertise and design decisions, turns the design process rather complicated. The difficulty inherent to visually represent both variables in one interactive system leads to a scarce number of these objects. The identified shortage of effective visualizations that best suit the intersection between the conceptual and contextual domains of time and space, is the bottom line for the research here exposed. For more frequent and satisfactory use of interactive ST visualization, it is a prerequisite to recognize what requirements, factors, and dimensions integrate an efficient graphical interface, and how they interact with each other.

Understanding the user's experience is an important step in designing any interactive system, including the context of information

visualization. Nevertheless, before getting to that step of concerns focused on the user, we believe that taking into account beforehand as many as possible arising decisions relative to this genre of visualization will facilitate the design process. Providing the designer with applicable tools resulting from empirical and theoretical knowledge may assist the author in covering the overall final user's experience effectively. Introducing theoretical frameworks, conceptual models, or other applicable tools into the design process contributes to an interchange between research and design. This articulation conducts to better design solutions, a more satisfactory final user experience, and, ultimately, the enhanced gain of insights. Specific and effective research makes a positive outcome more likely to be achieved (Augustin & Coleman, 2012), particularly when communicating complex information.

## BACKGROUND

Time and space are familiar dimensions that help us shape our individual reality. Thus ST visualization tools can help us better understand a plural part of the world and relate our reality in one specific theme with the "whole", considering different scales —local, regional or global— at a given time or time interval. The visualization of ST information has the power to display complex and compelling messages. It allows the user to observe, interpret and acknowledge the movement of objects, the occurrences or evolution of events, and locate them in both time and space.

Spatio-temporal visualization can be static, animated, or interactive. In Figure 1, one can observe small multiples, a series of maps showing the same combination of variables over time: the

distribution of droughts in the USA between 1896 and 2012 (Park & Quealy, 2012). Areas under moderate to extreme drought in June of each year are shown in orange below. Each line represents one decade, allowing the user to compare data between different moments and locations of interest. In Figure 2 (The City of Toronto, 2013), a 45 seconds animated video displays the evolution of the city of Toronto. Different periods of time are represented by distinct colors, where for instance brown areas depict buildings from 1850-1901, while blue areas mirror constructions from 1946-1960. By pressing play, the time-lapse starts displaying the changes in a one-yearly pace, allowing the user not only to understand the progression of the city limits but also to gain a final overview of the shape of the city in 2002.

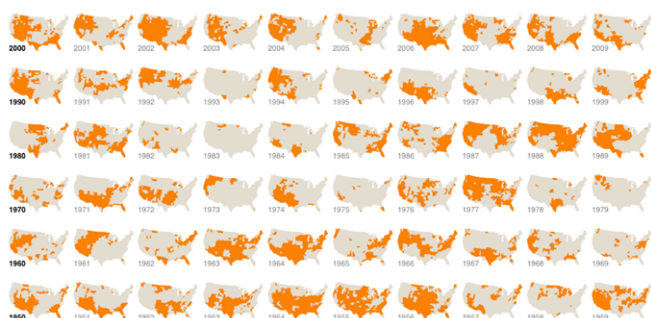


Fig. 1 – Drought's Footprint, NYTimes, 2012 (snippet)

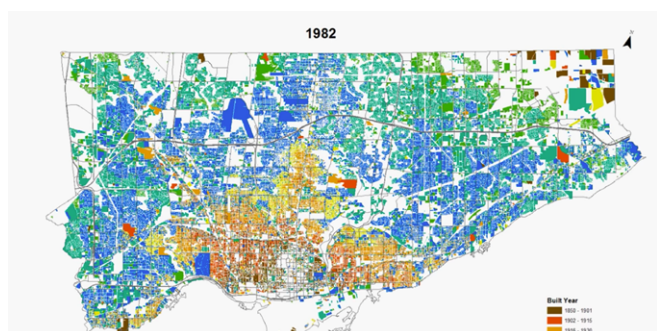


Fig. 2 – CityTimeLine 1900-2002, City of Toronto, 2013 (snippet)

When interactive, ST visualization provides the exploration, discovery, and analysis of complex information (Andrienko, Andrienko & Gatalsky,

2003). By allowing the manipulation of the visualization, it promotes the gain of insights through the identification of comparisons and proportions, the detection of trends and patterns, and the observation of connections and relationships within the data (Kirk, 2012).

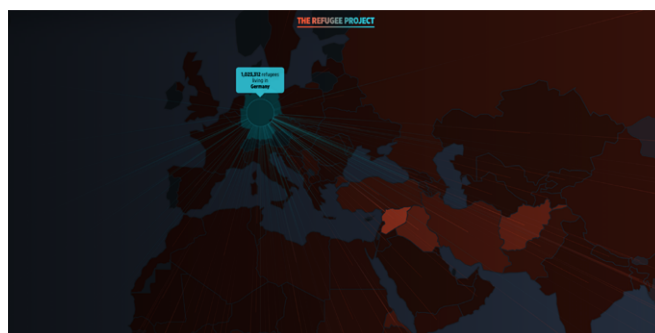


Fig. 3 – The Refugee Project, Hyperakt, 2004 (snippet)

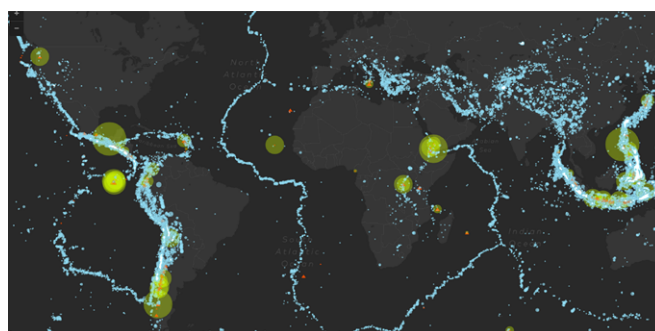


Fig. 4 – E3, Axismaps, 2016 (snippet)

The example found in Figure 3, “The Refugee Project” (Hyperakt, 2004), consists of one interactive map that looks beyond the last flee crises and allows viewers to learn about all refugee migrations around the world since 1975. This visualization has various key elements to improve the quality of storytelling and allows the user to zoom the map in and out, open details-on-demand, elaborate information on countries of interest, or select specific time intervals. On the other hand, Figure 4 displays an interactive time-lapse animation called “Eruptions, Earthquakes, & Emissions”, or “E3” (Global Volcanism Program, 2016). Here, the user can learn about volcanic



eruptions and earthquakes since 1960, and about volcanic gas emissions (sulfur dioxide, SO<sub>2</sub>) since 1978. The experience includes the selection of singular events for further reading, among other exploration tasks such as filter, zoom, control of time pace, etc.

## IMPLICATIONS OF SPATIO-TEMPORAL VISUALIZATION

Designers are constantly posing questions and answering them in the visual and interactive forms of the objects they develop. Their task is to translate both project-specific and generalized expert information into a language understood by users (Augustin & Coleman, 2012). This translation relies on human visual perception and the spatial arrangement of the interface's constituents (Manovich, 2010). When interactive, the visualization design requires extra knowledge, as cluttering the interface with dispensable interactive features should be avoided, since it interferes with the efficiency and effectiveness of the communication process (Kirk, 2012).

The information flow can be divided into two distinct parts (Cairo, 2013): one corresponds to the actions on the designer's side, and the other one refers to the reading phase on the user side (Figure 5). According to Cairo, the stage of visual-textual encoding results in how well the object adapts to the nature of the information. Additionally, this step depends on the intuition about the knowledge the user has on the topic. The complexity regarding designing ST visualizations relies on the diversity of mental models and specific knowledge that is required from the user to decode it.

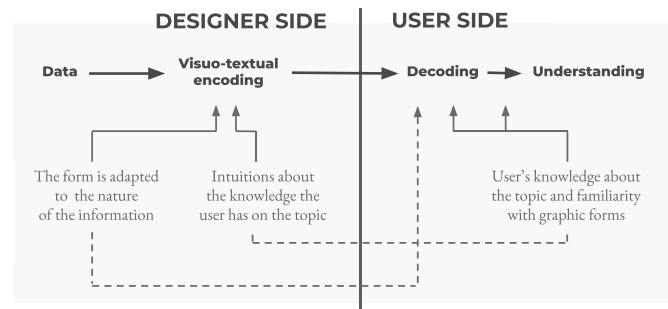


Fig. 5 – Designers encode, users decode, Cairo, *The Functional Art: An introduction to information graphics and visualization* [Fig. 3.9.], 2013, (adapted)

### INTUITIONS ABOUT THE KNOWLEDGE THE USER HAS ON THE TOPIC

In the specific context of designing interactive ST visualizations, there are many things to be considered. Previous research (Rodrigues, Figueiras & Alexandre, 2019) identified six main categories of expertise in ST projects: the communication purpose, spatial components, temporal components, usability practices, the storytelling structure, and technical concerns. To better understand the scope of each category, hypothetical key questions may be posed, as follows:

#### Related to the communication purpose:

Is the communicational intent to present information (explanatory) or to discover and analyze it (exploratory)?

What is the main purpose: to note comparisons or proportions, trends or patterns, relationships or connections?

Does the data translate Existential, Spatial, or Thematic changes?



### About the spatial components:

What type of map best suits the visualization: dot distribution map, proportional symbol map, choropleth map, network map, flow map, to name a few.  
Which map projection best suits the display of the data?  
At what granularity should space be scaled? Locally, regionally, worldwide, etc.?  
How much detail should the map include?

### About the temporal components:

Is the temporal dimension composed of time points or time intervals?  
Does the data represent linear or cyclical time?  
Should time be scaled in minutes, hours, days, years, etc?

### On usability practices:

How should the user navigation flow within the visualization?  
What elements need to be included in the user interface?  
Which interaction tasks make sense to include: overview, details-on-demand, filtering, selecting, encode, etc?

### On the storytelling structure

What narrative elements should be considered: introduction, title, legends, annotations, captions, etc.?  
Would complementary graphics such as line graphs, bar charts or histograms help convey the message?  
Would it make sense to consider sound for guiding the experience or note/differentiate events?

### THE TECHNICAL CONCERNS

What are the technical constraints within the data? Which coding language or software would best fit the project? What possibilities does the chosen language bring and what are its limitations?

The reasoning during the design process contemplates the making of conscious and consistent decisions. The designer would have to virtually master all categories to be able to answer every question and accomplish an optimal final visualization. Furthermore, the design process is mostly non-linear and iterative, spiraling or even chaotic (Moere & Purchase, 2011).

### DISCUSSION

According to Ullman (2010), the design paradox states that, throughout the project development, the more one knows, the less freedom there is to apply what one knows. Aiming the appropriateness of the final design object, the initial freedom found at the beginning of complex projects should be replaced with insights on the information to be communicated, intended audience, context of use, and possibilities and limitations of the chosen technology. Designers solve firstly this stage of problem identification and all subsequent problems that arise from it are answered by developing a research plan.

In the context of ST visualization, there are many different components to take into account. The translation of the interactive ST visualization components into design implications, both conceptual and project-related, may be summarized in applicable tools, such as frameworks or conceptual models. A pragmatic author-centered approach of research subsequently supports the process for user-

centered ideation and design. Towards the goal of better assisting the designer with a structured and pragmatic understanding of such complex communication objects, we propose an iterative, multidisciplinary, and author-centered process, based on the diversity of the categories previously identified. We assume that the research process for a successful ST project should integrate these three dimensions.

### **Multidisciplinary**

Designers deal with complex issues that can only be resolved by integrating materials and conclusions developed by people from different fields of expertise, and combining them with their own practice and professional experience. According to Augustin and Coleman (2012), agility in applying this prior knowledge is the stamp of an efficient designer. The design process for ST visualizations incorporates the collaboration between different parties such as designers, cartographers, journalists, and statisticians.

### **Iterative**

To deeply understand the overall requirements of interactive ST visualization, these objects may be considered under the domain of digital product design and incorporate Agile methodologies, including user research and usability best practices. Agile basic principles define that programs and applications must be executed in an iterative, incremental, and evolutionary way. The entire process emphasizes changes and adaptations of approaches, at any stage of the project (Beck et al, 2013).

### **Author(s)-centered**

Throughout the creation process, designers are successively asking questions and answering them through the numerous decisions they

make. Its role is the continuous and constant translation of unspecialized and specialized information into a language understandable by the end-user (Augustin & Coleman, 2012). This dynamic of repeated questioning leads to a permanent urgency of response, which in turn requires continuous decision making, analysis, and conclusion about the results of those decisions. The design process answers questions with physical forms and it is always good to keep in mind that “Knowing about something is not the same as knowing how to do it” (Sless, 1994). In any case, the designer and its performance are considered to be the key to effective communication.

Theoretical tools are lacking in the design practice and current research does not always achieve to establish a solid bridge between “research” and “design”. We aim to contribute to this dialogue in the context of ST visualization. For the development of specific theoretical tools, and regarding the complexity of ST visualization, a combination of techniques may be contemplated. From the research conducted so far — which includes literature review, case studies, and expert interviews — we infer that any theoretical tool relies on an author-focused, multi-disciplinary, and iterative design process.

This investigative approach prompts design to be considered, in its essence, a form of research itself (Downton, 2013). Nevertheless, this perspective of blurring boundaries between design and research is contradicted by many (Wang & Groat, 2013). The relationship between design and research is complex and organic: although divergent, it is complementary. Research adds one scientific essence to the side of the “art” of design practice. The security that science entails supports the intuition necessary for decision making and, consequently, the design of the object. It represents the mastery of theory supplementing

the designer's intuition with information and structured knowledge (Kieran, 2007).

The purpose of each of the areas distinguishes them: design is responsible for responding to a problem, while research is about answering a question. We can also differentiate research and design practice from its temporal focus: while design concentrates on an action focused on the future, in research it is implicit the notion of accumulating knowledge from the past (or the present). Finally, their contributions are also different: the result of a design project is a specific artifact and directed towards the respective initial problem — either a physical object, a system, or a process. In turn, the results in research originate widespread knowledge applicable to different situations (Wang & Groat, 2013).

Throughout the research conducted on the development of theoretical tools for ST visualization, we have realized that there are similarities between the requirements of creating these tools and the operational application of the tools themselves. The process on how to design theoretical tools was, as well, multidisciplinary due to the diversity of components that inevitably incorporate such information visualization: space, time, interaction, time or space interaction tasks, storytelling best practices, among others. The process was also iterative because it is only possible to conceive these tools by systematically combining different methods, such as case studies and specific literature review. For instance, each time a novel dimension is found in a new case of study, it automatically adjusts the outline of the criteria for the same analysis. Finally, the process for creating theoretical tools in ST visualization is naturally author-centered, since its primary goal is to assist the designer.

## CONCLUSION

Research, like design, is an evolved process. The designer leads dynamics that integrate a variety of experts and professionals while solving various problems at different scales (Augustin & Coleman, 2012). Providing the author with applicable know-how and tools that address all project components may be as relevant as understanding the final user's experience within the ST visualization.

The requirements behind the process for the creation of theoretical tools are similar to the processes suggested by the same tools. We conclude that the process of designing a ST visualization has that in common with the process that has formerly originated the research for the creation of the tool: they share three key properties — multidisciplinary, iteration, and author-focus.

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# Air travel: towards a new global experience

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## Abstract

This short paper is a summary of updated research for an ongoing product design project. The purpose of this project is to explore product and UX design in the context of airports and air travel experience. The target audience is both frequent and new flyers of international air travel, but also airport managers, architects and designers. In my experience as a professional designer, I did several projects for African airlines and design outcomes for this specific market on a regular basis. I believe this project could be very useful to understand the designer's creative role in airports that can reflect today's global network of air travel information.

The context of UX, product and information design in airports includes information design displays, airport architecture and interior design, airport management and flow control, signage and international pictograms, mapping and way finding, air travel design and air travel anthropology.

### Keywords:

**User experience design, Information design, Product design, Air travel.**

## INTRODUCTION

This project report aims to clarify issues about the research on a new product design for commercial air travel information. My research question is to set a new information system for the air travel, suitable for any international airport and therefore not in relation to an identity. Sub questions include: how can different variations of present information systems be integrated into one system? How can technology improve it? How to create a new system suitable for advanced and primitive airports? How can UX and design improve the air travel experience?



Figure 1 - A man ignores the information screen displays as he interacts with his mobile device.  
Terminal 5 - London Heathrow airport.

My field of study is set in two general areas:  
- user centred design, related to how the passenger perceives graphic information at the airport and how can this be used to control, expand and give more options for the passenger flow through the air travel experience; - visual dialogue, related to how to create a sequence of instructions for the use of the new information system at each stage of the passenger route.

## PROBLEM DEFINITION AND AUDIENCE

The problems that I identified with current information systems at the airport are related not to the information they convey, but to how this is done.

Symposiarch John Tackara (1994) refers that part of the problem about presenting information at the airport is related to the lack of creative solutions apart from the typical signs and maps.

The main problem I identified with international airport information systems was their dependence from the space, and not from the process, as it should be - because there is a sameness in the structure and in the process, regulated by the International Air Transport Association.



Figure 2 - A man ignores the information screen displays as he interacts with his personal laptop.  
Terminal 5 - London Heathrow airport.

Lisbon airport former traffic and stop assistant Rita Pinheiro (2008) has an opinion on the air traveler behavior, referring that “70% of the people lose their reasoning capacity when they enter an airport”.



“Lost in space” is how John Tackara (1994) explains the feeling about “a sense of rootlessness and anxiety”. This happens because of the relation between the air traveler and the air travel space and process, through the airport and the flight.

But the key to my outcomes will be to think not just about this relation but also in the global audience in which we are all connected today, in which we experience the same wherever you are in the world. As Jessica Helfand (2001) refers in *Screen*, “the new, contemporary audience is global, fractal and constantly on the move”.

## SPACE AND TIME

Today, an interesting personal approach in space experience is being developed as we have “google maps”, interactive video/audio tours in museums, and gps services in our smartphones, wearables and vehicles.

Dutch designer and author Edo Smithshuijzen (2007) realized the importance of today’s personal navigation systems saying that “gps navigation will change the need for signage in our environment” and points a series of relevant technological developments related to it.

The navigation service in my project should be designed to solve problems of signage. At the airport, there is no better way to guide someone showing the direction live, as one walks. Audio directions implemented in the service could also be a solution for blind people.

But the concept of time through the commercial air travel process is unique.

Marc Augé (1995) explains in *Non-places* that the airport is part of a super modernity where there is an “excess of time” related to the overabundance of events.

He also refers time as the typical unit for measurement in air travel, a fact easily understandable when we think about distance from our departure to our arrival, from check-in to gate: not meters, kilometers or miles, but minutes and hours.

So, it makes all the sense to use the unit of time in the system as well, and the navigation service becomes also important here as we can now know, wherever we are, how many walking minutes to our next destination.

## PROCESS

In designing new systems and categories for the product design outcomes, I will focus mainly on the process of the airport “machine”. Like I referred before, there is a sameness in the international airport process, so it was easy to adapt this to a global system, that is, if the process is global, by adapting this process the system will be global as well.

**The boarding/navigation guide service:** should be designed to quickly guide the starter and frequent passenger stage by stage, with hints on flow levels that you can avoid or where to use electronic passports.

The conceptual problems that I have to test are basically focused on “stop” stages of the process, being the airport a machine where “stop systems” integrate with “go systems”, this service should improve the time for waiting, checking, and... waiting again.



Figure 3 - Terminal 5 at London Heathrow airport.

**The flight details update service:** a way to think and design for those who have to wait but don't like to keep checking for flight updates in the airport display screens. Also, this way, airport managers don't have to add more and more screens in the already overfilled airport environment.

**The social/media entertainment service:** provides what today you have to access in an external online service, but that could be offered by the airport. For those who prefer to relax instead of rushing, flight details update notifications would remind them when to finally go for their next destination.

## INFORMATION

In my primary research I observed that information in air travel works in two ways: static and updated.

Static information is in the airport static signage and paper-based information (flyers, leaflets, etc.) and also in the traveler's boarding card (flight numbers, booking reference, gate number, etc.).

Updated information can be found mostly in screen-based platforms.

In order to proceed correctly to the airplane, the air traveler needs to be aware of both static information concerning personal details and updated information about the flight, and in order to this one needs to check both private documentation and public displays.

More and more electronic screens are being used in airports, due to the large amount of updated information to display and also security rules, that today can change in just one day. It's now normal for airport managers to invest in larger screens to present more and diverse updated information.

My new design project will gather most of these information systems in a private and easy way, an idea developed from internet systems that have become a vital part of communication nowadays, specially for airlines. But for the airport-based process it's not being used as far as it could be, mostly because in the airport the updated information that goes on the screen does not go to the internet, specially private/personal boarding information.

Besides screen information, also every paper-based information in the airport should be displayed in a new personal system (with a totally improved personal experience, cutting paper costs for the airport) and a social/media community can also be designed to share travel experiences and airport user information, making it an alternative and new information source.

## CONCLUSIONS

My project main outcome will set product design mockups for a new product design, explaining what these new online services should be and what can they do to improve the air travel

experience.

A presentation would be a marketing strategy for the design project, to persuade airport managers, architects and designers of the importance of the new system implementations in future air travel management.

In all outcomes I will use existing codes for communication in the air travel process, like the pictograms, and new codes, such as illustrations.

I am positive to say that sooner or later, similar systems would be designed, tested, and experienced by future generations and I hope this project can contribute for the development of better design solutions within future air travel demands.

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# Track

## Design for Tech and Digital Interactions

*Nowadays, technologies play a significant role in shaping the ways people experience the world. Technological artefacts may thus be seen as arguments about how people may lead their lives. Design is, in this sense, an activity that thinks beyond the materials in order to shape technology to better suit people's needs but also enable people to understand and use novel artefacts. Following this year's theme, this track is focused on the ideas, practices, and processes used in Design to make global technologies useful, delightful, and meaningful for people at a local level. We seek papers and proposals from different perspectives, by designers, engineers, scientists, etc. that discuss and explore new approaches and methods in interaction design, HCI, UX, research and applications contributing to this vision.*

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# The relationship between the interfaces and gamers' flow on Open-world RPG games

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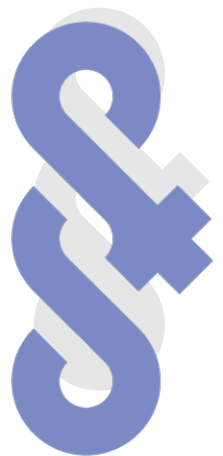
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## Abstract

This article focuses on the opinion of different types of gamers about Open-world Role-Playing Games (RPGs) with Hack'n'Slash mechanics and their interfaces. This descriptive research was carried out through interviews and web-based questionnaires to identify and validate preferences about this type of electronic game, its mechanics and interfaces.

## Keywords:

electronic games; games interface; user experience; human-computer interaction; ergodesign.



## 1. INTRODUCTION

There is a growing concern about the interface of the games throughout their development. In some cases, it is argued whether there would be too much information on the screen, making it difficult for the gamers to orient themselves. Furthermore, whether important information would not be available to the gamer when necessary. Hunicke (Hunicke, R., LeBlanc, M., & Zubek, R., 2004) and Ermi and Mäyrä's (Ermi, L., & Mäyrä, F., 2005) say that the relationship and the involvement that happens between games and gamers are individual phenomena - that is, occur in different ways for each gamer.

This article introduces a research conducted in Brazil, which required to substantiate our understanding of the universe of electronic games. One of the areas of interest is related to the basic perceptions about games, their types, and their characteristics. Open-world Role-Playing Games (RPGs) have been chosen for the context of this study, where "open-world" is a characteristic, not a classification. After the theoretical foundation, surveys were conducted with the gamers, i.e., face-to-face interviews and web-based questionnaires.

## 2. ELEMENTS USED IN ELECTRONIC GAMES

Firstly, we should understand what electronic games are and what constitutes them. Several authors and researchers work on defining what the act of playing is. Schell (Schell, J., 2008) describes games as something that involves feelings, with what is fun. What is fun directly influences the feelings and emotions, from happiness, enjoyable moments and pleasure, when the gamer performs of his own free will, without feeling obliged to it. Another definition of

games explains them as free movements within a system of rules and limitations. It is the process of playing, not an object – this characteristic is also confirmed by other authors, such as Schell (Schell, J., 2008) and Koster (Koster, R., 2013) in their respective books, *The art of game design: a book of lenses and Theory of fun for game design*. The gamer joins the decision-making system, bears the consequences of his choices, engages in a new moment, and then makes new decisions.

Besides the importance of the personal preferences of the gamers and their interest in the game, there is also the vision of the developers – who create the mechanics and challenges faced within the games. Upton (Upton, B., 2015) states that it is possible to perceive a standardization of these aspects when comparing games. He categorizes six general steps, which cover the common points of interest between them. These points should be thought so that there is a good interaction with the user, generating zones of action or interest (horizon of intent), which can expand or be changed as the development throughout the game, making it interesting for gamers. When playing and having these expanded zones, it allows an enjoyable gaming experience. These points of interest are as follows: choices, variety, consequence, prediction, uncertainty, and satisfaction. Gamers tolerate games that may or may not have more restrictions if, in the end, they get the feeling and possibility of reward.

## 3. ELECTRONIC GAME INTERFACES

Head-Up Displays (HUD) are based on visual elements. Their on-screen layout and presentation will vary depending on the time the game is released, the style, and which additional information will be offered to gamers, according to the developers. Each element is used to



communicate something in the game - the life of the main character or enemy, the shooting target, or help with important mechanical information for the game. The interfaces should communicate to the user what is happening in the game through specific feedback for each situation. (Nielsen, J., n.d.).

An interface trend in gaming is the attempt to implement as much as possible of the interfaces immersed in the gaming world. The reason is that developers believe the less disrupted the experience, the fewer screens appearing and beeping on the gamer's horizon, the more likely he is to be in a state of immersion and flow. These new types of elements are called diegetic, non-diegetic, metadata, and spatial (Russell, D., 2011) (Deshmukh, I., n.d.).

### 3.1 DIEGETIC

These are elements that are part of the game world, while also communicating something to the gamer. While the avatar interacts with the object, the gamer identifies a possible action (Stonehouse, A., 2014).

### 3.2 NON-DIEGETIC

They are elements that communicate something essential to the gamer outside the game world. A transparent layer running on top of what is going on between the game and the gamer; the avatar does not interact with these elements.

### 3.3 METADATA

Data collected by the game and the gamer is unable to see - not visual elements. For example, damages the avatar suffers when shot down. Some games allow the gamer to acknowledge them by placing drops of blood in the air when the character is hit.

### 3.4 SPACIAL

Elements that inform the gamer of something important, such as an object. It's located near the gamer, and he should check it out. It provides information from within the game world for the gamer but is not part of the story. Nowadays, one must be aware that some spatial elements, as a result of the game story, are classified as diegetic elements since there is interaction and needs the avatar during the action.

## 4. THE GAMERS

People play games so they can create unique moments, escape from reality, or face and overcome significant challenges. Thus, they validate sensations that are direct results of their actions (Lazarro, N., 2004). These interactions are, in many cases, relationships between different types of people, with different backgrounds, reactions, and perceptions. Users seek a game in which they can feel more immersed in the game world – with some kind of emotional connection. In order to be able to address types of games, there is research that aims to create taxonomies of gamers, according to their psychological characteristics (Lazarro, N., 2004; Bartle, R., n.d.; Yee, N., 2006; Gamification Co., n.d.). The BrainHex model (Hunicke, R., LeBlanc, M., & Zubek, R., 2004) is one of the studies that focus on types of gamers, instead of styles of gamers and what pleases each group. The result is seven distinct archetypes: Seeker, Survivor, Daredevil, Mastermind, Conqueror, Socialiser, and Achiever. The results are related to the 16 archetypes of Mayers-Briggs, which makes the answers more reliable concerning what the gamer feels when playing. The test consists of personal and game-related questions. This research is an excellent way to show that a gamer can have different gameplay styles, but there is always one that

predominates.

Simultaneously, researchers try to taxonomize the types of gamers, aiming to find the motivations for the users to play. Such is the case of Nicole Lazarro (Lazarro, N., 2004). Her theory consists of pointing out four key groups, relating each to what is considered fun by the gamers. These groups are as follows: Hard fun - the player is attracted by strategic opportunities and problem-solving; Easy fun - the player likes exploration and adventure, easily immersed in the game; Serious fun - the player has more visceral reactions, from his own experiences, and relaxes when completing his goals; and People fun - the main reason for playing is socialization and competition among gamers. In addition to the key points on why people play, Lazarro also identifies the feelings involved in each group mentioned above.

## 5. MOMENT OF FLOW

Psychologist Csikszentmihalyi initiated the flow study. He screened different types of people (from 1975 to 2000), whose activities brought them some kind of reward (Larson, R., & Csikszentmihalyi, M., 2014). The moment when the individual feels satisfied with the activity, losing track of time and other consequences, is called flow. The participants of the research had in common the practice of activities with the primary purpose of being pleasant, independent of the objective, and the extrinsic aspects of the original activity, thus being an autotelic activity. It is possible to identify factors that trigger the flow state while the individual is performing an activity: challenges or opportunities for action that balance the individual's skills; feeling that he or she is engaged in an activity appropriate to his or her skill level; clear and defined objectives; and immediate feedback on his or her progress, making the experience unique and personal. This theory emphasizes and

prioritizes the individual's relationship with the action environment. This dynamic demonstrates the pleasure of the activities, represented as challenging - physically and/or mentally - and with the need for skills, offering multiple possibilities of actions. When entering the flow state, one can perceive striking and subjective characteristics: intense concentration on the activity; action and consciousness together; loss of self-awareness as part of a social group; lack of awareness of hunger and vital needs (what is happening around you and yourself); feeling of power and control over everything that is happening and over future events and consequences of the decisions; loss in one's temporal consciousness. Being engaged in the activity is intrinsically rewarding. Typically, the goal becomes an excuse to go through the process.

Chen (Chen, J., 2006) defends the theory that games should give freedom to players to choose the challenges based on their skill level. Thus, they gain control of their progression, making options that make sense for their game style and staying within their flow zone. As previously said, each individual has the power to balance the skill level and their choices throughout the game, to prevent them from leaving the flow state. This design choice ensures higher dynamics and flexibility, thus attracting more players. Maintaining feedback on actions is an essential factor. Jane McGonigal (Scott, R., 2014) comments that games are becoming more popular because they contain messages and positive affirmations for gamers. These messages enhance the gamer's commitment, while identical actions in real life do not receive the same support and recognition. One situation may cause confusion between flow and immersion since the consequences are similar. The person loses track of the external world to which they are connected, paying attention only to what is in focus. The concept of immersion within the universe of electronic games is commented by Janet Murray (Ermi,

L., & Mäyrä, F., 2005) as the experience of being entirely involved by the environment or other reality. This immersion can be guided by the sensory senses, based on challenges or imaginative (Ermi, L., & Mäyrä, F., 2005). Flow and immersion are subjective states. Their consequences and how they are expressed are different for each individual. Thus, we can understand why specific people adapt to different kinds of games.

The researchers Hunnicke et al. (Hunnicke, R., LeBlanc, M., & Zubek, R., 2004) believe that what attracts the players are the characteristics of the games – what is considered “fun” –, therefore, they made a taxonomy of “fun” as Sensation, Fantasy, Narrative, Challenge, Fellowship, Discovery, Expression, and Submission. These categories can blend and form diverse types of games, which can attract attention and be successful with different kinds of gamers. Each game with its predominant and peculiar characteristics, and others that may appear throughout the game, thus influencing the goals and means of achieving them.

## 6. RESEARCH METHOD AND TECHNIQUES

For the initial research, it was necessary to validate what was studied in the theoretical framework of the electronic games area. The following phases of the study were based on research techniques that focus on individuals, on what players understand regarding electronic games. The first technique consisted of a semi-structured interview with players of different levels and skills, who were not involved in game design. The second was the web-based questionnaire with an analysis of the Likert scale.

The purpose of the interviews was to provide an understanding of what players think about interfaces, flow and immersion of games, and if there is a relationship between these aspects, etc. Once this step was completed, the findings of the interviews could be confirmed or refuted with a larger sample of gamers, based on the questionnaire.

The main prerequisite for choosing respondents was whether they played or have played on consoles (PlayStation, Xbox, Nintendo, or others) in the six months prior to the survey. The interviews were previously scheduled, confirming the age and the prerequisite via text messages, telephone or social media, and were carried out individually in places with minimal external interference. Eighteen interviews were conducted, guided by a list of questions, and each session lasted an average of 20 to 40 minutes.

The intention was to learn what the respondents understood about what makes up the interface – elements, preferences for the final visual appearance of games during play – without sticking to the specific game styles of the survey. Next, questions related to the particular types of electronic games chosen as the focus of the research - RPG, open-world, Hack'n'Slash (HnS) mechanics and its interfaces. These questions contributed to understanding whether there was a difference between interface preferences concerning different styles of electronic games. Such questions contributed to understanding whether there was a difference in interface preferences for different styles of electronic games. The last set of questions was aimed at understanding what the gamers understood as flow and immersion, if they believe they can reach that state while playing, what makes that happen, and what causes them to leave that state. Those questions were to identify the aspects that were most pleasing to gamers and whether the games' interface could have any effect on entering or leaving that state. The second step (the web-

based questionnaire) also in sets of questions and answers in Likert scale, aimed at confirming the data from the interviews, thus increasing the number of respondents to a total of 127 gamers who got the questionnaire link via e-mail and friends who shared the link among gamers groups.

## 7. JOINT ANALYSIS OF THE INTERVIEWS AND QUESTIONNAIRES RESULTS

First of all, these studies were conducted with human beings; therefore, they include some obstacles, such as less objective results, according to the possible variations in respondents' discourses, such as personal preferences, and analyses under the researcher's view. From the joint analysis of interviews and questionnaires, some interesting answers were identified. Some respondents preferred little or no non-diegetic interface on the screen (see Fig. 1), while others explained that they adapt to what is offered in the game, or understood the needs and mechanics of each game. However, there were no comments about missing elements during the game.

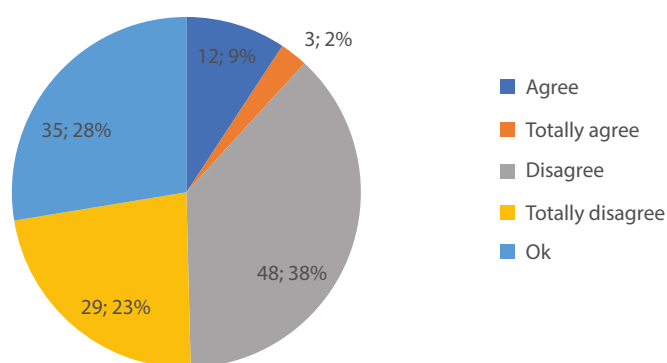


Fig. 1. Affirmation of preference for non-diegetic elements in games

Regarding the types of games mentioned – RPG, open-world, and HnS –, there were no discrepancies in the answers that might indicate preferences associated with specific types of gamers. The same is true for questionnaire responses. There were few direct associations to types of gamers. However, it did not happen with all the affirmations, which indicates that the answers show the personal preferences of individuals as gamers and not sorted by types of gamers.

Initially, an important aspect noted was that when asked about what they understood as the games' interface, they mentioned non-diegetic elements. Only after the development of the interviews, and later confirmed in the questionnaires, the other diegetic, sound and physical interface elements mentioned. Similar was the case when players were asked about the same idea, specifically about RPG, Open-World, and HnS games. Some respondents suggested that the interface should be treated as a complement to the other elements that make up the game, should be made subtle and should not distract the gamer; when it fulfills this role, he then considers it to be a good interface. It should be fluid and follow the aesthetics of the game. Other interface elements were listed as important components and accessories, in addition to the visual interface, namely audio and physical interface.

Other gamers remarked during the interview that they preferred games with no, or almost none, non-diegetic elements on the screen, so that they would have more autonomy in decision making and not feel influenced to do something out of the information on display. During the questionnaires, the majority agreed that the diegetic elements alone are enough for gamers to make decisions within the electronic game. The preference for diegetic elements is high but not unanimous. Therefore, some non-diegetic elements are necessary. The next chart (see Fig. 2) examines the inefficiency of the diegetic elements

for gamers to make decisions on their own. From the minority who agreed on the inefficiency of the diegetic elements, it is assumed that non-diegetic elements are necessary for some gamers. These are dependent on the objective of the game for a better option that makes sense for the gamers.

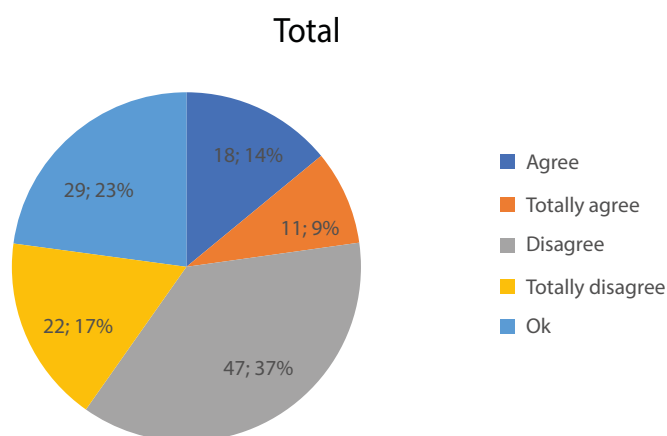


Fig. 2. Affirmation that diegetic elements do not benefit the gamer to make decisions within the game.

During the questionnaire, the majority of voters disagreed with the idea that non-diegetic elements improve the gameplay of electronic games. The diegetic elements are the ones preferred by gamers. However, the majority of gamers of the survivor type, who prefer horror games, with more adrenaline, did not agree or disagreed with the statement. Horror games, which according to the BrainHex research site, are preferred by this type of gamer, feature minimal non-diegetic interface outside the screen's action range.

During the interviews, there were disagreements about the definition of the types of games. The most controversial was related to computer role-playing games; some respondents explained that also in talks between friends, this subject does not reach any conclusion. Some people mentioned that the most important thing is for the character to reflect the player, a system of improvements and levels of the character and equipment, while

others focus on the missions that the gamer must accomplish, or it's just a system of battles. Regarding RPG videogames, many said over the interviews that they prefer the diegetic and spatial elements; others like to have some non-diegetic elements, displaying the important information; and few said that they don't care about the elements themselves, because they adapt to whatever is on screen. Regarding open-world games, the elements most commonly mentioned were still the non-diegetic interface, since the gamers interviewed understand that these are the elements that make up the interface, providing basic information for the player. However, there is still a preference for diegetic elements, allowing the gamer to choose and focus on the game's discoveries. Some respondents said they prefer more diegetic information, with only the most essential non-diegetic interface displayed, depending on the purpose of the video game. Regarding the questionnaire, the answers referred to the diegetic and spatial elements as the primary support for decision making by the gamers. The preference is still for the diegetic and spatial elements. Nevertheless, the non-diegetic elements are specific and minimal for each type of game.

When compared with the types of games mentioned above, for the specific mechanics of HnS, the presence of non-diegetic elements was mentioned and preferred, but to provide relevant information. This would be a game feature that requires specific non-diegetic elements, as some players explained, such as the life of the character and the enemy, or weapon ammunition. Concerning the flow and immersion in video games, some other elements, besides visual interface, were mentioned. They believed they influence the relationship between gamer and the video game, such as the audio and the narrative of the story. Other aspects mentioned in the interviews and confirmed in the questionnaire refer to the necessary synchrony between the

visual, the audio and the story, throughout the game – the story as the most important and influential factor for the flow to happen (see Fig. 3). It was not possible to find specific data for the interface itself to be considered the main factor to enter the state of flow and immersion - besides the narrative, the difficulty of the challenges, and the sense of progression and evolution. On the contrary, gamers indicated the story as being the most crucial factor to reach the flow state. This fact supports the idea that the interfaces are complements for the flow to occur.

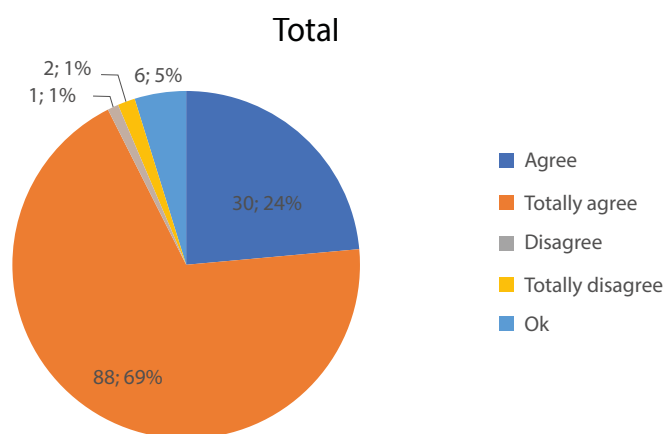


Fig. 3. Affirmation that the synchrony of the story, visual and sound interface allows the gamer to enter a flow state.

As for the moment when individuals come out of immersion, the factor that most influences it is the external events to the game, for example, someone calling them. Within the game, different disengagement factors were discussed, some that do not frustrate the gamer to the point of interrupting the game, and others that irritate the gamer and make him quit playing immediately, such as the level of difficulty of challenges or the elapsed time. Some said that when they reach the goal, they feel “fulfilled” and confident to rest and play again later on. Some comment that they

don’t like it when the game reminds them that it is just a game when the loading screens between scenes remind them of the real world, such as checking the time on the clock, causing them to leave the flow. Comparing with the moment when the player starts immersion state, the events in the course of the game and the interface as they are presented appear with more frequency in the answers as reason of end of flow – a decisive factor for the end of the flow when playing, but not necessarily decisive for the gamer to stop playing (see Figure 4).

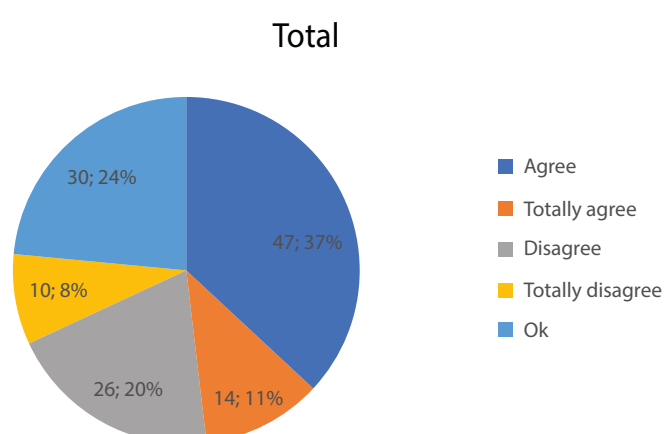


Fig. 4. Affirmation that despite disorganized visual interface, the gamer is annoyed, but continues playing.

With the findings from the interviews and the questionnaire, it is clear that the interface can be one of the causes of flow loss. However, it is not the primary cause and is not universal for all individuals to enter the flow. These findings are individual, unrelated to specific types of gamers. After the joint analysis, a mind map was developed and named UXMITI, listing the motivations of the gamers to play, the reasons for immersion, and the types of interface noted by the gamers, thus generating reasons for their relationship with each other (see Fig. 5).



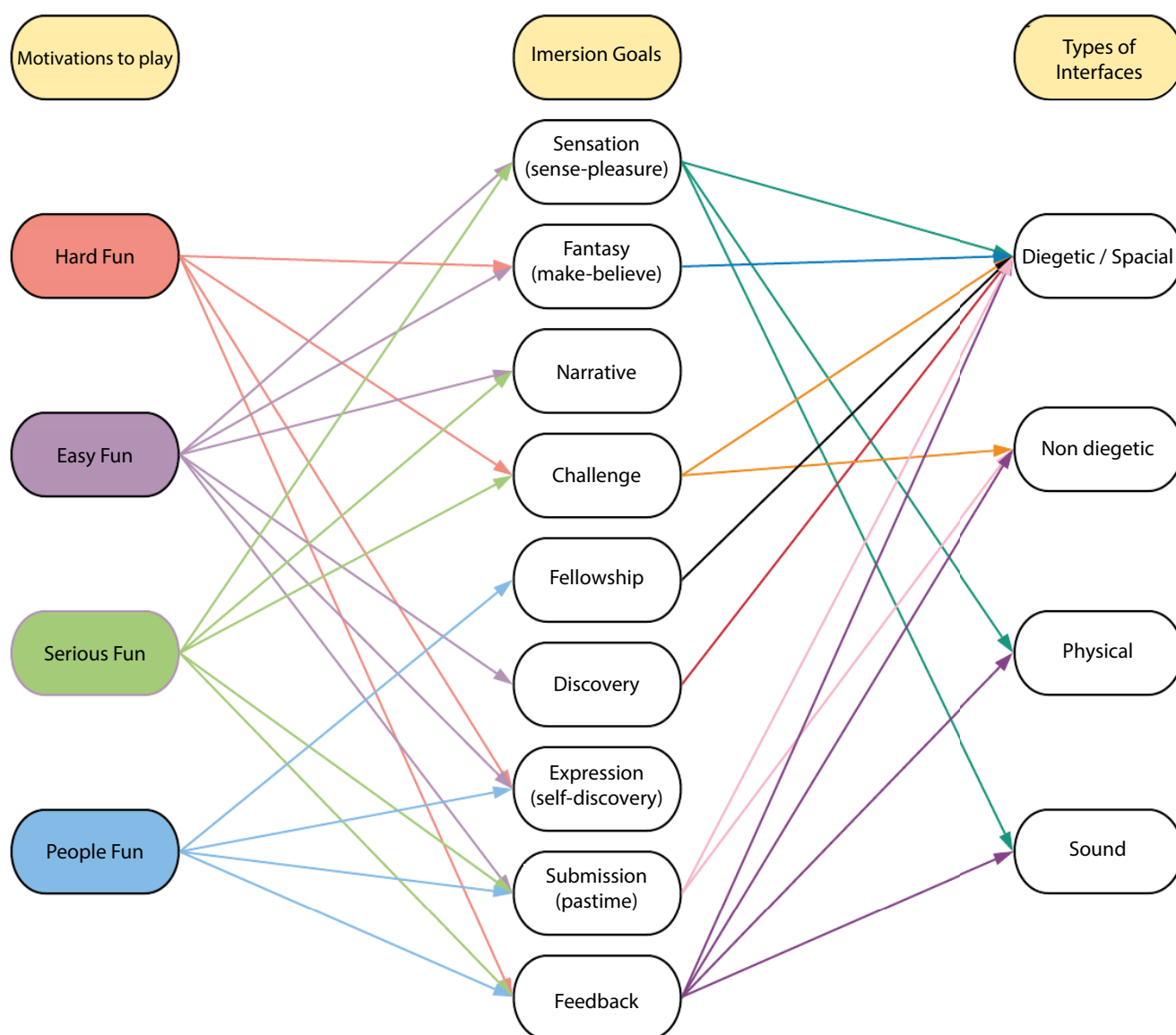


Fig. 5. Authorial image of the mind map, UXMITI, relating gaming motivations. Lazarro, motivations for immersion and types of interface.

## CONCLUSION

This paper focused on the visual interfaces of computer RPG games, open-world, with HnS mechanic. The visual interfaces are elements that are important for gamers to receive information throughout the game, influence the flow state, and start making important decisions. This

research had as its premise that the visual interfaces can interfere in this relationship, in a way, both advantageous and undesirable, depending on how it can be used within the virtual world. The objective of this paper was to identify the types of interfaces that could affect the gamer-game relationship and verify the possibility of associating aspects and elements of the interface with the existing types of users. The techniques used in the research were sufficient for the first stage. However, for more objective answers, more time, and a larger sample of



players is required. It is still unclear what specific elements can interfere negatively and how this occurs.

The answers found in this survey are not conclusive about the specific preferences of each type of gamer concerning the interfaces of video games but indicate that there are personal inclinations on particular characteristics that can be analyzed and if patterns are found within the sample.

When players were asked about the electronic game interfaces, it could be noticed that the non-diegetic elements were the most used to define the HUDs. However, while progressing with the interviews, this definition was expanded and contemplated other elements, such as diegetic, spatial, sound, and physical. Often, without the player realizing that he is referring to them. Both in the interviews, as in the questionnaire, the individuals judged the diegetic and spatial elements as the most important for the gameplay, to decide actions, receive information, and better gameplay as a whole. This pattern of response was sustained both when questioning about video games in general, regardless of game genre, as when defining the type of game for discussion, such as RPG and open-world games, for the research.

A small deviation of analysis was found when the games interfaces that present the HnS battle mechanics were investigated. For these types of games, individuals were in favor of having some non-diegetic element to present essential information. However, it is interesting to note that such individuals have indicated that they might prefer that this information, which is important during the battle, would be more useful if it were presented in a diegetic form in the game.

In the course of the interviews, it was reported that the game-gamer relationship is fluid when the mechanics follow a logical functioning. For example, when using real-world physics, such as water against fire, and gravity. When the game

has its own physics, if the patterns used are logical and easy to learn, players tend to prefer not to follow a different tutorial at each level – where patterns change every moment –, forcing them to renew their acquired knowledge constantly.

Other elements that help the relationship flow between the gamer and the video game, besides the mechanics logic, are the narrative, the gamer's sense of progression in the game or evolution of his character, the possibility of exploration, and the audio, or sound effects and soundtrack. It was noted that the interface itself does not cause the state of flow or immersion of the gamer; rather, it assists him together with the factors mentioned above. The gamer may not consider that interface to be the ideal or the best; however, if the set pleases the gamer, he can enter the state of immersion and flow.

However, in exceptional cases, the interface elements can cause a significant strangeness for the gamer and cause him to leave the flow and immersion states. For instance, people mentioned moments when the diegetic elements are malpositioned, and the gamer can't identify an item that should be found or get stuck in the bushes during a battle. Such contingencies can bring unnecessary challenges, as they put it, and frustrate the gamer.

This research has confirmed that the interface plays an important role in computer RPG games, open-world, with HnS mechanic battles, as elements that offer essential information to gamers. However, developers should be aware of how this information is introduced to gamers. Although the interface itself does not lead to gamer flow or immersion, it may cause a sense of wonder about something visual, and in many ways, lead to the gamer's frustration.

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# “Beyond your human concept of gender”: discussing gender and virtual assistants

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## Abstract

This study aims to explore the relationship between gender and artificial intelligence, questioning how digital assistants tend to be feminized through their anthropomorphization, the tasks they perform, and their socio-emotional interactions. It draws on a previous study and analysis of digital assistants such as Alexa, Cortana, Google Assistant and Siri and furthers the discussion on their stance towards gender, considering the features that are being prioritized in AI evolution. It then tackles the main questions raised by researchers and academics when examining the phenomenon and confronts these views with common conceptions and concerns around the feminization of AI as discussed in online media coverage. In this manner, this study seeks to promote discussion and incite reflection on the issues that inform the relationship between gender and AI.

## Keywords:

artificial intelligence, chatbots, anthropomorphization, gender, femininity.

## INTRODUCTION

Artificial intelligence has already become part of our daily lives: mobile devices have it, social networks want it and it seems like every computer coder wants to learn how to make it, whether it's for an app, a website or instant messaging platforms. We frequently interact with this type of systems, namely with digital assistants, which, as artificial intelligence's increasing ubiquity often goes unnoticed, are becoming a natural part of our daily interactions. They are now embedded into our mobile devices and web-based services, not only assisting us in daily tasks but increasingly acting as friendly companions. In an attempt to become closer to our social reality, they are assigned human-like traits, features or even personalities. However, this growing anthropomorphization inevitably entails gender attribution which, in this context, tends towards femininity, resulting in a behaviour that conforms to certain stereotypes and reinforces traditional assumptions of femininity (Hester, 2016; Bogost, 2018).

Drawing on a previous study, we address the relationship between gender, as commonly perceived under a binary framework, and the integration of artificial intelligence in our daily lives, revealing how digital assistants emulate feminine features through their anthropomorphization, their assistance role and their behavioural traits (Costa & Ribas, 2018). Commenting on this phenomenon, the project *Conversations with ELIZA* was developed to ironically expose and reflect common stereotypes and gender assumptions in AI.

This paper expands on this discussion, highlighting which functions and features are being prioritized in current developments of AI, complementing a previous analysis of digital assistants, such as Alexa, Cortana, Google Assistant and Siri. The analysis reveals how these entities tend to

behave in an affectionate and feminized way, be it through their voice, the tasks they perform or by assuming behaviours that are traditionally deemed feminine, even if some also behave in ways that are not exclusively associated with femininity (Costa, 2018). Acknowledging that some of these assistants try to counter this tendency, we address the main questions raised by researchers and academics when examining this phenomenon, while confronting these views with common conceptions of AI feminization, as discussed in the context of online media coverage. In this manner, this study seeks to incite reflection on the social and cultural conventions that inform the conception of artificial intelligence, and spark discussion on how digital assistants end up reflecting these views back to us.

## HUMANIZED AI, FEMINIZED LABOUR AND AUTOMATED FEMININITY

Embedded into devices of daily use, digital assistants are moving from mere assistance towards daily companionship, being increasingly endowed human attributes in order to turn "our interaction with this type of machines into a more social one" (Weber 2005: 209). In this process, and as we have argued elsewhere (Costa & Ribas 2018), they tend to portray gender related attributes, be it through their voices, names or the way they interact. This phenomenon is influenced by the way gender is commonly perceived under a "binary framework", which regulates the type of behaviour we establish socially (Butler 1990: 88). This gender belief system imposes expectations, normalizing what is deemed feminine or masculine, thus leading to "prescriptive gender stereotypes" (Prentice & Carranza 2002: 269).

On another hand, the tasks these assistants perform also conform to a structural hierarchization of labour relating to gender roles, or the fact that a lot of service work and emotional labour, namely within the private sphere, is associated with women (Hester 2016: 47). Digital assistants mainly operate in service or assistance related contexts, thus automating work traditionally coded as feminine, thus evoking what Donna Haraway defined as a “homework economy” reinforced by computational media, or a “restructuring of work that has the characteristics formerly ascribed to jobs done only by women” (Haraway 1991: 304).

So, besides evident features like voice, name (or avatar), which condition our perception of the assistants’ gender before any interaction, they also become gendered entities through their social interactions, as these tend to conform to “stereotypical and gendered behaviour patterns” (Weber 2005: 215).

As digital assistants try to become closer to our social reality, it is from reality itself that they draw rules for their behaviour and we end up perceiving these entities not only as mere machines but also as “mirrors or substitutes” (Weber 2005: 216). Consequently, the way we relate to our peers starts influencing how we relate to digital assistants and how these entities relate to us.

Drawing on these ideas, the project Conversations with ELIZA ([tinyurl.com/yaecumal](http://tinyurl.com/yaecumal)) explores the observable femininity of digital assistants, by presenting four chatbots with different personality traits, dialogues and tasks that evoke how AI and femininity are perceived in popular culture, while taking inspiration from AI archetypes in bodies of fiction and traditional female stereotypes (Costa & Ribas 2018). Acknowledging that there is little agreement on how to approach gender assignment in the context of AI, the project ironically exaggerates and accentuates female stereotypes, roles and behaviours, seeking to

incite reflection on the subject.

## ANTHROPOMORPHIZATION, ASSISTANCE AND COMPANIONSHIP

Conversations with ELIZA was also informed by an analysis of general personal assistants, particularly Alexa, Cortana, Google Assistant and Siri, regarding their anthropomorphization, the tasks they perform (as assistants) and their humanized, socio-emotional interactions (as daily companions).

We observed the dominance of feminine features, considering their names and default voices, since they often lack male or gender neutral options (with the exception of Google Assistant and Siri). Considering their assistance role, they all perform a similar set of tasks, related to what Dale calls “the standard virtual assistant skill portfolio” (2016: 812), which tend to mirror traditionally female labour.

Additionally, their behaviour, as expressed through interaction, frequently displays caregiving attitudes that characterize them as understanding and reassuring entities, while personality traits deemed as male, such as being assertive, dominant or willing to take a stand seem to be lacking. In this manner, they automate sociality, emotionality and femininity, since these attitudes conform to a “stereotypical female image of caring, empathy and altruistic behaviour” (Gustavsson 2005: 402 in Hester 2016: 47). Not only do they fill the role of assistants, but they also promote a relationship based on friendship, generally assuming a submissive posture with the exception of Siri that tends to reject compliments and condemn negative attitudes.

In sum, Alexa and Cortana are presented exclusively as female entities, articulating these attributes with a motherly, caring and submissive role. In turn, although Google Assistant and Siri also tend towards feminization, they try to oppose

this tendency diversifying their behaviour and offering multiple voice options.

Complementing this analysis, we focused on which functions and features are being prioritized in the development of general personal assistants, concerning their growing ubiquity, efficiency, humanization and their stance towards gender. One of the main trends is to humanize these assistants by deliberately turning them into friendly daily companions so the dialogue feels “personal and natural” (Huffman 2018) and “users don’t even know they’re using [an] assistant” (Boweden 2018). As Hester argues, femininity is being instrumentalized in order to achieve this goal, by persuading the imagined technology user (Hester 2016: 40).

Awareness of this issue is shown by Apple and Google, since their assistants offer alternatives to the female voice and also assume behaviours that do not necessarily echo traditionally female traits. They seek gender diversification moving from assistants that are “female in character”, as said by Alexa, towards those that “try to stay neutral”, like Google Assistant, or those that even state they are “beyond our human concept of gender”, like Siri. Nonetheless, as neutral or genderless as digital assistants might try to be, female attributes, particularly regarding their voices and names, are still prevalent when compared to neutral or male counterparts. This leads us to expand on the debate on gender neutrality and diversification on digital assistants.

## **GENDERED AI: JUSTIFICATIONS, CONCERNS AND SUGGESTIONS**

So, we then sought to confront our observations with the main questions and concerns that arise, or even suggestions, when discussing the feminization of AI within specialized fields of knowledge, such as artificial intelligence, gender theory and new media studies. We also tried to

understand how popular notions and assertions about this phenomenon are being debated in more ordinary terms, namely in (online) media coverage.

The fallacy of gender neutrality is often debated, and some argue that “when voice technology is embedded in a machine interface (...) it may trigger in the user’s mind a whole set of expectations associated with that voice’s gender” (Nass 2006 in Piper 2016: 58). This view reinforces how female features are prevalent when compared to neutral or male counterparts. Although virtual assistants aim to appear neutral and disembodied, it is commonly argued that they embody the archetype of a “competent, efficient and reliable woman” (Steele 2018). In this sense, common media discussions emphasize that users tend to attribute gender to entities that may not have an apparent one, and thus interpret the personalities of these entities through the lenses of their own biases, namely often addressing assistants by the pronoun “she”.

Common justifications emphasize that feminine voices are better suited for virtual assistants because their voice is easier to perceive and because women are more caring than men (Piper 2016: 34). On one hand, it is argued that the tasks these assistants perform tend to “exploit our assumptions about feminized labour” and caring behaviours (Hester 2016: 50). On the other hand, it is also discussed how this technology is designed as explicitly feminine (and submissive) in order to “emphasize human dominance over technology” (Kerr 2018).

Another common belief is that femininity emerges as a consequence of having artificial intelligence being developed mainly by men (LaFrance 2016). This is also suggested in a very recent publication by the United Nations, addressing the digital skills gender gap, but also emphasizing the social and cultural repercussions of the rise of gendered AI (UNESCO 2019). When talking about the predominance of female voice, some also argue



that the male voice is preferable in instructing or teaching contexts, since it's authoritarian and assertive (IBM's Watson is an example). Adding to those justifications, are the concerns about how gender stereotypes "seem to be so deeply ingrained that people even apply them to machines with a male or a female appearance" (Eyssel and Hegel 2012: 2224). Accordingly, one of the main issues around female voices is how their associated nurturing, caregiving attitude can be instrumentalized to ease anxieties surrounding virtual assistants. Some authors go further to say that this neutralizes the perception of a strategic move for surveillance capitalism tied to increased access to all types of information about users (Woods 2018). Additionally, some authors also point out how virtual assistants "will never leave their users or disappoint them with infidelity, so consumers trust their possessions and value them more than the human beings around them" (Piper 2016: 62). Common media discussions are also concerned with femininity being the default in digital assistants as it might reinforce preexisting expectations on how women should behave, arguing that "when we can only see a woman, even an artificial one, in that position, we enforce a harmful culture" (Steele 2018). Consequently, it is also highlighted how "today's children will be shaped by AI much like their grandparents were shaped by a new device called television" (Rosenwald 2017).

There is, however, little consensus on how to counter this phenomenon. As previously observed, gender neutrality in digital assistants is often questioned and considered hard to achieve, since their voice immediately conditions our perception of the AI's gender. Often brought to the fore, are discussions about the unassertive way digital assistants react to harassment and how their reactions convey stereotypes about women (Curry and Reiser 2018: 12). A common view is that virtual assistants should allow for more diversity, for example by offering a "simple

setup guide during startup of devices with virtual assistants" (Piper 2016: 65). And some authors advance that "allowing virtual assistants to possess no gender, or a gender as fluid as that of human beings, would hopefully be part of their humanization" (Piper 2016: 66). As such, it is common to find suggestions proposing androgynous, genderless or fluid assistant. In sum, the debate is growing, in both specialized and common terms, showing increased awareness and critical thinking around this phenomenon, however emphasizing different issues. Media discourse essentially advances justifications for feminization, often resorting to common assertions about user preference or, again, reinforcing the perception that AI is a field mostly developed by men. The growing humanization of machines appears to serve three main purposes: "to make sense of a situation by projecting a person's own behaviours (...) onto an unfamiliar object; to reduce the feeling of uncertainty in a situation by predicting the behaviour of the other agents; and to establish social connections" (Lopatovska & Williams 2018: 11).

According to this idea, within the fields of artificial intelligence and gender theory, the tendency is to discuss the way femininity tends to be instrumentalized, questioning who this truly benefits. Some argue that they aim to achieve a positive perception and experience of the users and that a technical system is perceived more vividly by anthropomorphizing and humanizing it. Others claim that, in truth, this humanization masks the corporations' ultimate intention, as a means of neutralizing veiled surveillance.

## CONCLUSION

In conclusion, with this study we sought to tackle the questions that arise with the growing ubiquity and humanization of AI, and its inherent stance towards gender. As digital assistants become

more humanized and increasingly play the role of friendly companions, they inevitably tap into gender conceptions, as we observed in Alexa, Cortana, Google Assistant and Siri. Although current developments are not naïve to their feminization and seem to move towards a more unbiased characterization, there is yet little consensus on how the issue can be addressed. Observing this phenomenon, researchers and academics highlight the way gender is instrumentalized to ease interactions and persuade the imagined technology user. In turn, common discussions in the context of online media coverage often advance user preference as to justify the tendency of feminized AI, while also emphasizing how the field is mostly developed by men. Although there is little agreement on how to tackle these issues, neutrality is often questioned in favour of gender diversity, namely, allowing the user to customize the assistants' presentation and behavior. Other authors point out how these entities could fluctuate between more than one gender, thus possessing a gender as fluid as that of human beings, instead of perpetuating traditional binary conceptions. Current trends in the development of digital assistants reveal how these entities are becoming more and more ubiquitous and how they globally reflect the cultural conceptions that guide their characterization and behaviour. Consequently, there is still a need to further discuss issues related to gender portrayal in AI, veiled surveillance or even the impact this technology might have on newer generations.

As future work, we intend on further developing the research's practical component, namely through bots that gather data for the analysis and bots that further discuss gender attribution in artificial intelligence.

As part of an ongoing research, this study sought to raise awareness and foster debate on how artificial intelligence is influenced by our social and cultural views. As these entities proliferate

into our daily life and become closer to us as companions, perhaps we should be more conscious of their ethical implications, and the way they reflect common assumptions back to us.

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# Playing with Radon: a learning experience for prevention

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## Abstract

The paper sets out the results of a research project focused on the definition of specific communication tools related to risk communication and education for health prevention about Radon gas. In particular, an interactive board game was designed, based on the Jumanji model, to be used in schools, aimed at stimulating positive cognitive processes in the digital natives, through the use of virtual cards and recognized language codes. The game is translated into a playful experience, applying the educational approach “learning by doing”. Simulation in play of the risk conditions, associated with Radon, creates greater awareness and induces correct behaviour in children. The specific subject of this project is Radon gas, but the results obtained in terms of method can be applicable to other situations of risk. The difficult and sensitive nature of the problem required an interdisciplinary approach, in which science, technology and humanities collaborated to define a complex and articulated model, aimed at building an effective communication system towards non expert and sensitive users for risk reducing.

## Keywords:

**Design for Interaction, Risk communication, Information Design, Living Lab approach, Hybrid Board Game.**

## 1. INTRODUCTION

The communication of complex issues, characterized by complicated and little-known scientific aspects, is a particularly difficult area. If these issues also involve biological risks on human beings, communication actions must follow more articulated paths, in order to generate knowledge and awareness without causing unnecessary alarmism (Fischhoff, B., 1999). Radon gas belongs to this category. Unconscious exposure to high concentrations of gas represents a significant risk for the health of the exposed population, which largely, at least in Italy, still ignores its existence and related problems.

In addition, the analysis and prevention of risk phenomena is important for the whole community, it is not possible to identify an exclusive type of end user. Users are all the citizen, the person responsible for public and private buildings, the traffic police, the person responsible for school buildings, technical offices, local health authorities and health care workers, design engineers, technicians in charge of environmental monitoring.

Starting from these premises, this paper present some applicative results of a research project<sup>1</sup> still active, aimed at the definition of specific communication tools related to risk communication and education for prevention related to Radon gas. The general objectives of the project are:

1. the development of an innovative product, based on ICT technologies, for Radon detection and alarm communication, to be placed in public and private buildings;

2. the production of a technical manual of risk identification in different construction situations based on architectural typing;

3. the multi-level information of users, through specialized products and communication processes, different and targeted to various classes of users, from children to adults. For each of the classes identified, specific communication tool has been chosen characterized by different level of interactivity appropriate to the user: printed dissemination documents, a website, an App for Smartphones, dedicated pages on Social Networks. In particular, this paper details the design process of an interactive board game for educational activities of school children, to demonstrate the potential and educational value of traditional products that combine technology. For them a school experience has been designed with a kit for use in the classroom, including:

1. Radon presence simulation devices, for a sensory experience;
2. board game, to learn by doing, through interactive game tools.

The remaining part of this paper is so organized: section II gives some elements on the nature of Radon gas; section III shows a brief overview about the field of investigation and presents the method adopted in the design process; in section IV the state of art about game design and education is discussed, while section V describe the design of the experience. Finally, section VI reports final remarks.

## 2. RADON

An act of communication necessarily requires knowledge of the specific object of that communication. Radon gas is not a simple subject, as it belongs to several fields of science, from

<sup>1</sup> Radon Project: active participatory system for raising community awareness of Radon gas exposure. It is a project funded by Apulia Region, in Italy, with Innolabs Call of POR Puglia FESR ESF 2014-2020. Sub-Action 1.4.B. Scientific Coordinator for Poly-technic of Bari: Prof. Vincenzo Di Lecce; head of the Technical-Scientific Committee for Polytechnic of Bari: Alessandra Scarcelli.

physics to geology; moreover, due to its effects, it involves other fields of knowledge, from biology to medicine, up to the techniques of materials and construction.

In this section, on the one hand, the most relevant aspects of the nature of Radon, which affect the life and health of the human being, are presented; on the other hand, the problems related to communication are described.

## 2.1 ABOUT RADON

Radon is an inert radioactive natural gas produced following the decay of others chemical elements as thorium and uranium. The Radon decays emitting ionizing particles, namely additional radioactive elements in solid state that adhere to surfaces and airborne particulate matter that spread in the air. Radon can accumulate in buildings, in confined environments below ground level, in low areas such as basements and cavities, where in some cases it can also reach high concentrations. Unintentional exposure to radiation from Radon gas is dangerous for humans, in fact it is considered the most common cause of lung cancer after tobacco smoke.

The World Health Organization has classified Radon in Group 1, which lists the substances declared carcinogenic to humans. The Italian Higher Institute of Health has estimated that in Italy the number of cases of lung cancer that can be attributed to Radon is 10% of the total.

The Euratom<sup>2</sup> has issued several guidelines for protection from exposure to ionizing radiation, including Radon (Directive 2013/59/Euratom), by setting threshold levels. Some European countries have responded to these guidelines through laws, recommendations and sanctions.

Italy, with a non homogeneous presence of Radon in the whole territorial area, is a country at risk, and it is not yet protected at a regulatory level. In recent years, only a few regions have enacted specific laws addressed to workplaces and specific

places open to the public. This approach, actually, excludes a large part of the community from regulatory obligations and consequently from knowledge of the phenomenon. Information campaigns to the community, in particular to non-expert users, about problems related to gas exposure, risk prevention methods and intervention procedures are inadequate and poorly solved.

The Radon project has been activated and financed precisely, to respond to this information gap, through the design of innovative solutions related to the technological product and multi-level information (Amato et al., 2019). The sensitive nature of the problem required an interdisciplinary approach, in which science, technology and humanities collaborated across the board to define a complex and articulated model, aimed not only at reducing risk but at building an effective communication system towards users, in particular the non expert and sensitive users.

## 2.2 RADON COMMUNICATION

The issue of communication related to Radon arises from the real difficulty to interpret as a risk something that is not perceived on a sensorial level. Radon is in fact colorless and odorless, so it is not possible to see or smell it. It is not a gas leak

<sup>2</sup> European Atomic Energy Community (Euratom) is an international organization established in 1957 to coordinate the Member States' research programmes for the peaceful use of nuclear energy, and to help to the pooling knowledge, infrastructure and funding of nuclear energy. One of the specific tasks of Euratom is to establish uniform safety standards to protect the health of workers and of the general public and ensure that they are applied. Each Member State lays down the appropriate provisions, whether by legislation, regulation or administrative action, to ensure compliance with the basic standards which have been established by the Treaty, including the necessary measures with regard to teaching, education and vocational training. Legislation has also been adopted on medical applications, research, the maximum permissible levels of radioactive contamination in food and the health protection measures to be taken in the event of a radiological emergency. (<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Axy0024>)



or a toxic cloud, the human sensory organs are not able to perceive it.

Moreover, the field of interest is very complex, as it involves specialized scientific areas of physical and biological science that are alien to everyday life. Radon is monitored in stationary air conditions by special detection instruments, which require highly specialized personnel to code the risk values. Talking about 300 Bequerel or 3.5 milliSievert to an ordinary person is of no use. A non-expert user cannot read these particular units of measurement related to ionizing radiation; at the same time, user cannot read and compare such data from a table.

The objective of community safety requires the identification of customized communication processes. For this reason, it is necessary to define both the content of the messages and the appropriate language to convey them.

Environmental risk does not have a shared code of signs that can support a recognizable and effective communication, and currently this leads to a situation of confusion due to the overlapping of different and unsuitable codes.

Risk Communication was born as a branch of Communication, specialized in the definition of principles and methods useful for the construction of effective messages (Lundgren, R. E., & McMakin, A. H., 2018; Cerase, A., 2017). Especially in the field of communications design and visual communication (Lipkus, I. M., & Hollands, J. G., 1999; Eppler, M.J., & Aeschimann, M., 2008). Radon has been one of the topics most widely addressed by Risk Communication since the late 1980s: the first Citizen's Guide to Radon, an information document produced and disseminated by the U.S. Environmental Protection Agency, refers to this period in order to reduce domestic Radon exposures. The guide is one of the first examples of communication tools with attention to the quality of risk messages. Weinstein et al. (Weinstein, N. D., Klotz, M. I., & Sandman, P. M.,

1988; Weinstein, N. D., & Sandman, P. M., 1992) have tested the communicative validity of this document, also through comparison with other similar documents, noting several difficulties of interpretation, and proposing improved versions.

### 3. METHOD

The research presented, for design aspects, is part of product design, and in particular refers to some instances of the User Centred Design Methods (Norman, D. A., & Draper, S. W., 1986), in the development of new products with a strong technological component, characterized by user/machine interfaces. In fact, in the project can be found some fundamental points of this approach: experiential and emotional involvement of the user in the definition of artifacts; iterativity of the experiments in order to allow the repeatability and scalability of the results; multidisciplinary of the research team that includes the component of design, biology, computer engineering, social and cognitive sciences.

The user-oriented design approach is also supported by the use of the Living Lab model (Kareborn, B.B., & Stahlbrost, A., 2009; Tang, T., & Hamalainen, M., 2012) as an operational methodology, in order to promote social innovation processes: the project is fundamentally based on direct interaction and co-design with the final recipients of the results, thus allowing the impact of new technologies on the territory and its actors to be realized, with particular attention to the sustainability of the interventions.

In the project, particular emphasis is given to Information Design, as a discipline capable of translating complex and multidimensional information and cognitive objects into their graphic representations, reworked and simplified to make them easier to understand (Jacobson, R., 1999). In particular, Information Design intervenes in the design and implementation of interfaces

between the user and digital devices, such as technology detectors or websites, and especially in the design of the game. Information Design concerns the design of visual communication, in the development of effective information devices by means of to a conscious and validated use of signs. In this sense, the models of communication processes analysis are relevant, taking in account they derive from semiotic disciplines, which allow processes of construction/deconstruction of a sign, or more generally of a message, are relevant. Therefore, in order to make this communication accessible, useful and understandable, for the design of all information documents, it was necessary to clearly define the elements of the communication process, consisting of the message, the code and the recipient. For each interface designed, the phases of the project have been:

1. identification of objectives; 2. user analysis; 3. definition of language.

In the first phase, the analysis of the objectives makes it possible to frame with greater precision the recipient type of the communication process, as it defines characteristics and scope of action of the user class. For the category related to children, the communicative product chosen is an educational game, specifically a game meant to teach in schools. The choice to promote this communicative activity towards these specific users is part of the perspective that these children will be the citizens of the future and, therefore, we need to educate them from the beginning. The main objective for this product is the development of a risk awareness of exposure to radiation, which can compromise the health of the user. This can occur through the transmission to the child of notions about Radon, which give a global picture of the physical phenomenon. To this class of users, from 6 to 14 years old, it is very difficult to communicate such complex scientific themes as Radon. Traditional communication tools within schools (frontal lessons, even if

supported by video or interactive materials) can be ineffective in these cases, in all children, but especially in the more lively ones or those with a low level of attention. The general divulgation objective related to safety, moreover, leads to the development of processes that aim to involve the largest number of users: the objective is not to forge a few experts, but rather to actively engage everyone. In order to intervene on children's behaviour, inducing preventive actions, the project must be based on the theoretical principles of "learning" rather than on the intrinsic rigidity of "training"<sup>3</sup>.

For the second phase, in order to analyze the user, the research has deepened the themes of cognitive processes in children and the effects of play on learning. Numerous scientific literature has addressed issues related to cognitive processes in children, in different age groups, defining the most effective actions for teaching. In order to attract their attention and curiosity, it is necessary to use tools and ways of emotional involvement, which transform the educational activity into an experience. The game is a particular form of experience, which requires specific conditions and environments. In this perspective, Norman (Norman, D. A., 1993) identified some useful factors for the educational experience of the game, which have been adopted as guidelines in the design of the Radon game:

1. provide a high intensity of interaction and

<sup>3</sup> There is no clear distinction between the terms learning and training, which are often used interchangeably. The most holistic definition of learning has been considered here, as a knowledge process leading to the acquisition of competences and greater adaptability. For a broader discussion on differences in meaning, see Wills, M. (1994) "Managing the Training Process: Putting the Basics into Practice." *Journal of European Industrial Training* 18, (6) 4-28; Garavan, T.N. (1997), "Training, development, education and learning: different or the same?", *Journal of European Industrial Training*, Vol. 21 No. 2, pp. 39-50; Masadeh, M. (2012) "Training, education, development and learning: what is the difference?" *European Scientific Journal*, Vol. 8, No.10.

feedback;

2. have specific goals and established procedures;

3. motivate;

4. provide a continual feeling of challenge, one that is neither so difficult as to create a sense of hopelessness and frustration nor so easy as to produce boredom;

5. provide a sense of direct engagement, producing the feeling of directly experiencing the environment, directly working on the task;

6. provide appropriate tools that fit the user and task so well that they aid and do not distract;

7. avoid distractions and disruptions that intervene and destroy the experience.

Among the most widespread and consolidated educational methods, the most recent “edutainment” (neologism that merges educational and entertainment) has an important characteristic, as it embraces the positive aspects of different approaches: first of all, the practice and experience of “learning by doing”, then it also develops proactivity, trains the Team Work and practices Peer Education. Specifically, in board games, children learn to respect the rules, developing creativity and critical thinking (McFarlane, A., Sparrowhawk, A., & Heald, Y., 2002). The experience, positive and negative, translates information into action, allowing them to experiment in an active way and to involve sensoriality. In edutainment, technology plays a fundamental role, as it is aimed at a very young audience.

Today’s children have different abilities from those of the last century: they are defined “digital natives”, millennial generation, for their natural ability to interact with digital devices. Therefore, different educational tools and methods must be developed for them, in step with technology (Prensky, M., 2012).

## 4. EDUCATIONAL GAMES

For the development of information systems suitable for children, the focus was on game design (Crawford, C., 1984; Wolf, M. J. P., 2001; Rollings, A., & Morris, D., 2004), for the creation of a board game integrating an interactive component. For such young users, the best way to learn is by playing. Learners do not perceive the educational process as an effort, because they approach it with a sense of challenge and fun. The choice of this particular playful product is derived from the observation that today the popularity of Hybrid Board Game (HBG) is on the rise (Kankainen, V., & Paavilainen, J., 2019). Some studies (Fang, Y., Chen, K., & Huang, Y., 2016) have demonstrated the validity of traditional board games, in comparison with digital computer games and videogames, for their physicality versus virtuality, and for the possibility to share the experience in a social sense with other players. Integration with a digital component, from bluetooth to Smartphone cameras, Augmented or Virtual Reality, to scannable Qr codes, can add *new levels of intrigue and excitement but still maintain the social factor that video games lack* (Rizov, T., Djokic, J., & Tasevski, M., 2019).

The Kickstarter platform demonstrates the renewed interest in board games (Hall, C., 2018; 2020), and in particular towards innovative HBG prototypes, from thematic to strategic ones, from laptop versions to role-playing games (RPG). There are several game classification (references), but in the case of HBG there is not yet a clear definition to define a taxonomy for this game category. A diversification according to the degree of interaction was the most useful for the development of the project; this identifies three types of application for games:

1. companion apps, which support the game

instrumentally by simplifying certain activities, such as point counting, money exchange (Monopoly), master narrative (Mansions of Madness), or offer game statistics - their absence does not affect the game;

2. support apps, which are integrated into the management of the game, dictating times, mechanics, settings (Alchemists, X-Com) - in some cases it is indispensable, in others not;

3. game apps, which represent the core and the main experience, without which it is not possible to play (Golem Arcana, World of Yo-Ho).

Educational Games in the form of video games, such as Oregon Trail and Reader Rabbit, are popular in school educational activities, while HBGs are not yet exploited, although they are currently widespread among young people. Some educational games for children, with interactive component, have been recently developed by Polytechnic of Milan in collaboration with the game designer Albertarelli: thanks to the funding of European research projects, the research group has produced educational games for schools, Drop and Funergy, aimed at raising awareness about water waste and energy saving (Albertarelli, S., et al., 2017). In both cases, the game involves the integration of technology, through the use of Smartphones and dedicated Apps for reading Qr Codes on special cards<sup>5</sup>.

The innovativeness and complexity of the final product involved an analysis of the diversified scenario: on the one hand, some traditional board games with an educational characteristic were analyzed to determine the most suitable type of games to raise awareness on the subject; on the other hand, some HBG were examined to understand the potential of technological integrations and choose the most effective ones in relation to the theme and the young age of the users. Among the traditional board games, Jumanji was the most interesting because of its

affinity of objectives, its pedagogical approach and its spirit of collective sharing.

## 5. RADON GAME EXPERIENCE

The result of investigation process was the design of a learning experience through play, to be carried out in primary and secondary school classes.

The experience consists of two consequential activities: the first, to be carried out only the first time, is related to the acquisition of content; the second is playful. The first activity is divided into two phases (Fig. 1):

1. preliminary phase - the teacher explains to the children both the rules of the game and some basic notions about Radon, to support the final overcoming of the game;
2. sensory phase - simulation of the danger of Radon from the perceptive point of view, stimulating the senses in the comparison between olfactory and visual consistencies of different gases, through vaporizers and non-toxic perfumed essences.



Fig. 1. Test with the children: preliminary phase and tools for sensory phase.

Finally, during the play activity, the children challenge Radon on the board game, demonstrating their acquired knowledge.

4 <https://boardgamegeek.com/boardgamefamily/41489/digital-hybrid-app-required>

5 <https://www.youtube.com/watch?v=sKOuxWR9kg0>

6 The Radon game is a HBG designed by Federica Gentile, Marina Ricci and Adriana Ro-meo, students of the Design for Interaction course, proff. V. Di Lecce, M. Fiorentino and A. Scarcelli, academic year 2018, Master's degree in Industrial Design, Bari Polytechnic.



Radon Game is a hybrid board game, designed and prototyped jointly with some students during the Design for Interaction course<sup>6</sup>. The aim of the game is to make children aware of Radon prevention. In particular, the child is expected to learn about Radon; to detect Radon; to discover its risks; to learn how to defend himself against Radon. In fact, it is a thematic game, set in a familiar space, a house, where you can meet some dangers related to Radon. In order to proceed in the game, must correctly answer questions related to Radon gas, so with skill and even a little luck, it's possible to defeat Radon and win the game.

The basic game has a simple mechanics, consisting of a game board, four pawns, a numbered die, a Saving Die (4-sided die), a Radon figure, a timer, 40 quiz cards, 20 danger cards, a quiz booklet. The mechanics are basic to facilitate children's activity, directing their attention to correct answers, rather than memorizing complex rules.

The game board represents a real house, with its rooms: entrance hall, living, kitchen, bedroom (Fig. 2). The graphics adopted are plain, with a comic book style, not realistic. The colours are bright and reassuring in the domestic family area, while they are dark and gloomy in the outdoor area, related to the danger of Radon, where the symbols of radioactivity confirm and strengthen this association.

Radon game is designed for four players that cooperate together, converging in the same point, the most dangerous space, the basement, that is the Radon's den and the point of arrival of knowledge. The 4 players have their own individual path, an elementary path similar to the Goose Game. The pawns move from space to space by rolling the numbered die. Whoever gets to the bottom of the course first wins and saves everyone. But the game board, Radon, can also win. It's not a strategic game, but semi-collaborative as it requires you to share some



Fig. 2. Game board graphics.

choices to avoid being overwhelmed by the common enemy. On the outer sides of the house is in fact represented a grid, the Radioactive Area, which collects the cards not awarded to players: once the Radioactive Area is completed, the victory belongs to Radon. The path is characterized by four different kinds of space:

1. Blank space. The player draw a question from the quiz card deck: if answer is correct, the player gains position, otherwise the player will move back.
2. Danger space. The player draw a danger card that is read through the Smartphone App. The App will display the solution to the danger, a symbol that all other players must be able to match either by rolling with their Save dice, in the time of an hourglass. If all players can find the symbol, they will advance by the number of spaces shown on the card. If one or more of them fails, the player will move back by the number of

spaces shown on the card. The card will also be placed on the Radioactive Area Grid.

3. Radon space. The Radon figure is placed on the next space and blocks the way until the player draws an even number, or another player saves or another player moves in Radon space.

4. Save space. The player can decide whether or not to unlock another player blocked by Radon figure. If so, the player advances one space. The player who arrives first in the gameboard center, the house basement, is the winner. Danger card contains information on the danger in which the player comes across and the saving symbol. In addition, this card is configured as a target image: this means that this card, when framed by the smartphone camera, can be animated and give the player an augmented reality experience<sup>7</sup> (Fig. 3). The card comes alive, colors and materializes. The danger cards are divided in different sections for contents: Radon and molecules; materials of Radon; interior conditions for Radon.

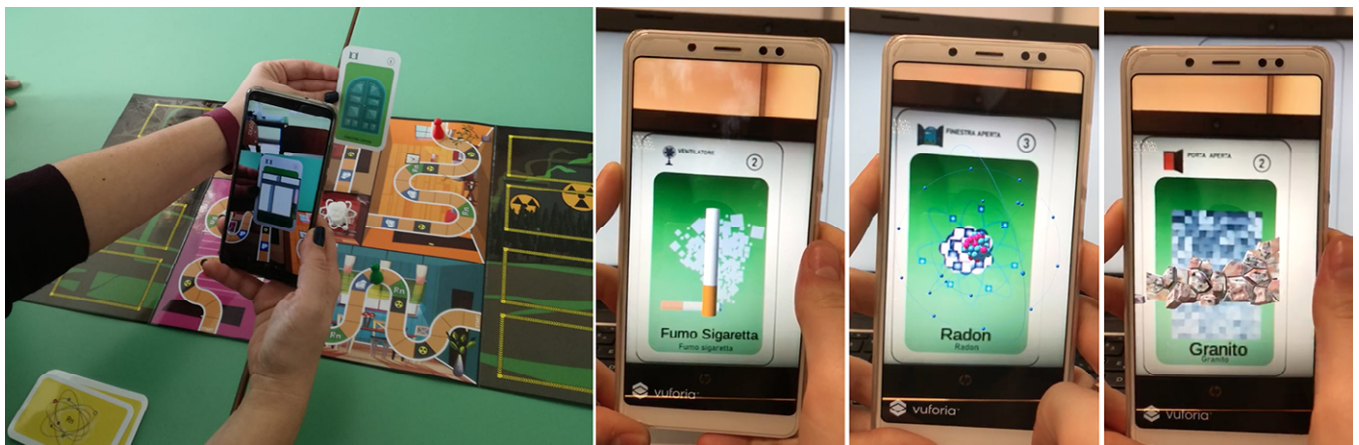


Fig. 3. Augmented Reality of danger card display on smartphones.

<sup>7</sup> Augmented reality was realized through the Vuforia software development platform integrated in Unity3D, which allows to build dynamic virtual objects and to visualize them through the recognition of target images with the camera of a mobile device.

Through the application, the virtual object seems to be part of the real world scene. The virtual animation displays the solutions to the danger, communicating the right prevention actions in risk situations: open the windows, put on the mask, ventilate with aerators, quit smoking, and more.

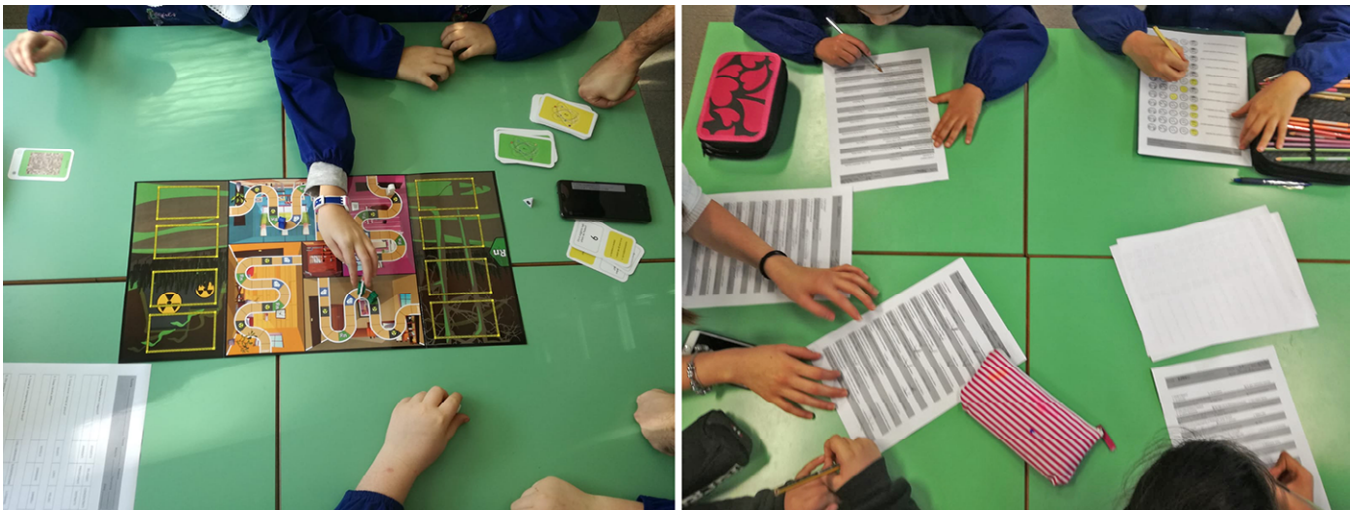


Fig. 4. Test with the children: game phase and final evaluation phase.

The prototype of the game has been tested in real situations (Fig. 4), according to the Living Lab approach, involving 11 school classes for a total of 160 children (8-12 years old). The experience was carried out according to the planned phases, and was evaluated through qualitative questionnaires given to the children: 12 questions mainly focused on the perceived quality of the aesthetics and graphics of the product, the ease of the game's mechanics, the level of knowledge acquired through the game, the desire to repeat the experience and share it with others. The result of these tests shows on all points a high level of appreciation, almost always over 90%.

## CONCLUSIONS

Contemporary society is a Risk Society (Beck, U., 1992), characterized by numerous risk situations involving human health and safety. The risk can be natural, health, technological, economic. Risk is everywhere, from earthquakes to floods, from road accidents to intoxications. However, risk is unpredictable, invisible, immaterial, it becomes recognizable only when it manifests its

damages. The current Corona Virus pandemic is a demonstration of this. The only tools to defend the human being are prevention through correct information.

In this perspective, the project presented attempted to promote prevention actions towards the risk of unconscious exposure to Radon gas in very sensitive users, primary and secondary school children. This action took the form of a playful experience, applying "learning by doing" educational approach. The game, in fact, helps children to deal with complex topics in a light way, involving them more effectively. The simulation in the game of the risk conditions associated with Radon can create greater awareness, and induce virtuous behaviour. On the other hand, other risk situations are already dealt with in schools, such as the simulation of evacuation procedures for earthquakes.

The Living Lab approach, adopted in the research project, made it possible to test the designed experience in real situations, and therefore to validate the choices in terms of objectives and tools. The involved children responded enthusiastically to the experience, asking to repeat it several times in a row, but they also



required the physical game, so that they could share it with family or friends.

The communicative objectives of the project were fully achieved, in terms of learning and sharing in the school and family community. Moreover, the collaboration between school and students, and also families, makes the activity even more useful, motivating everyone to pursue increasingly concrete and strong goals.

The specific subject of this project is Radon gas, but the results obtained in terms of method can be applicable to other situations of generalized risk.

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# The contribution of Design in developing digital interfaces for products aimed at senior populations

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## Abstract

In 2050, the SUDOE territorial area will have 40% of the population over 60 years old, thus containing the oldest population in Europe. There is therefore a need to develop products and services adapted to the needs of the elderly, and thus, to invest in Silver Economy.

ICT4Silver, an Intereg SUDOE project, is a consortium of 30 companies in the Southwest Europe territory which proposes to support and develop technological products that are targeted at improving the quality of life of the senior population.

In the framework of the ICT4Silver project, the work presented in this paper has the following main objectives: the study and redesign of three products that were a part of ICT4Silver, with digital interfaces and with the potential for aiding senior population, and the creation of design guiding principles (DGP) of digital interfaces, focused on the elderly.

The DGP are divided into three guidelines: characteristics of the senior user; learning processes; and UX (user experience) and UI (interface usability) design.

The final objective of this project is the application of digital interface DGP in those 3 products, namely: ArkeaOnLife (a fall detection system), PhysioSensing (a balance assessment and training platform) and Kwido (a mobile information exchange application).

## Keywords:

**UI/UX Design, Communication Design, Senior User, Silver Economy, Digital Design.**

## 1. INTRODUCTION

The problem presented by the ICT4Silver project, the increase of the senior population in the Southwest European area (SUDOE), is a trend that has been observed all over the world, especially in developed regions such as the United States, Japan and Europe. The imbalance resulting from this demographic change creates worrying social and economic problems, with inevitable consequences. With the increase in the senior population, pension and health costs increase; and with the decrease in the young population, the population capable of helping in the needs of the elderly also decreases (Dominguez, 2001). On the other hand, older people have a better quality of life and are increasingly active.

This reality of the senior population encourages the emergence of new solutions for this type of user, particularly in the area of *Information and Communications Technology* (ICT) and specifically in the design of digital interfaces (Hawthorn, 2006).

Nielson (2013) presents studies on the need for older people to use digital interfaces to access the Internet. These studies reveal that in more developed countries, most populations are already connected to the Internet, even in less accessible places. However, the generation of older adults encounters numerous barriers in their use. In 2002, in the United States, about 4.2 million users were already connected to the Internet and by 2012 about 19 million (Nielson, 2013). These figures show an exponential rise in the use of digital interfaces for the Internet and a concern to adapt products with digital interfaces for senior users. Studies also found that users were not taking advantage of all the potential services as they were researching but not making the purchase (Nielson, 2013).

Usability studies on the Internet have demonstrated that the increase in elderly people using the Internet has driven changes in the development of interface design, making it easier and faster to use (Pernice, 2012).

The present work was conducted in the framework of the project ICT4Silver and its main objective is to contribute to inclusive digital interfaces development, with a particular focus on Design adapted to the senior population. The approach was implemented for 3 case-study products, which thus immediately benefited from this work.

## 2. OBJECTIVES

The main objective of this work to contribute to the improvement of the relationship between the elderly user and ICT products with digital interfaces. In this sense, a set of UI and UX Design guidelines were studied and created with the aim of assisting designers in designing inclusive graphic solutions for the senior population. From the developed study, *design guiding principles* (DGP) were also implemented in three different products of the ICT4Silver project: ArkeaOnlife, PhysioSensing and Kwido. This way, a set of solutions was presented with the objective of making these three products properly adapted to the senior user.

## 3. METHODOLOGIES

Based on the products proposed by ICT4Silver, we began by studying the competing products on the market in order to find design features relevant to this study. Subsequently, the research focused on the analysis of a set of studies carried out by

the ICT4Silver consortium, namely the usability surveys and tests, which were conducted in the three representative countries: Portugal, Spain and France.

The practical phase of the project was divided into two stages of development: the development DGP; and the second stage, on the application of DGP in three different products.

In the first phase, the DGP are developed following three guidelines: the characteristics of senior users; learning; and the design of digital interfaces.

In the second phase, the redesign of the ICT4Silver project products was implemented, based on the developed DGP. The problems of the three products under study are structured, based on surveys and usability tests, as well as on the use of the DGP carried out.

## 4. TECHNOLOGY, SENIOR USER AND DESIGN

The adoption of technology by the elderly depends on two important factors: the usefulness of the technology and the ease with which they use it (Hawthorn, 2006). Technology has made great strides in several fields essential to individuals' daily lives, providing a dependency on technology. The degree of experience in technology by older people shows great variability, from older people with regular contact with the technology to other older people who have never experienced a computer, for example. Older people, compared to younger people, have significantly less use of the technologies. This is partly because older people feel less comfortable and more anxious about using this type of device (Hawthorn, 2006). The lack of interest, skill and perception is justified by the elderly, by the difficulty of use. Statements such as "feeling too old to learn" are manifestations of prejudice, very present in this group of older people (Czaja et al.,

2019).

The two main points that must be considered in the design process are the usefulness of the product and usability. Positive design in ICT should go hand in hand with the concept of "technology utility for the elderly", namely the advantages and facilities that the product can offer them.

Czaja et al. (2019) presents technology models such as the *Senior Technology Acceptance Model (STAM)*, and the *Unified Technology Acceptance and Use Theory Model (UTAUT)*. These models are based on ease of use (effort expectation) and perceived utility (performance expectation). If a technological product is perceived as useful to perform a task and is easy to use, the probability of being accepted and adopted by the elderly is higher. Specifically, in the senior user, the STAM model was developed specifically to explain the use of technologies for the senior.

Mitzner, considers disabilities resulting from health conditioning as the major problems of the elderly in the process of using technological products (Mitzner et al., 2018). According to Garcia (2001), the elderly have no predisposition to learn how to deal with new technologies (cited by Pereira, 2014). The elderly have a tendency to develop fears in a wrong use of a product. The learning processes of the elderly should emphasize the advantages and benefits of technology and increase the perceived usefulness, in order to compensate for the lack of confidence of the elderly.

As older people perceive the technology as being useful and easy to use, its uptake tends to increase. Technological comfort and cognitive skills are also factors that influence the adoption of attitudes in favor of technology that allied to a practice of use, increase self-efficacy and mastery of learning.

It is also important to note that ICTs have a different impact in different countries as well as in different areas within a country. Urban areas have greater access to technology, such as the

Internet. On the other hand, in rural areas there is less contact with the technologies. According to Czaja et al.: "lower socio-economic level, higher disability, advanced age and living in rural areas are factors that are negatively associated with the use of technologies for the elderly" (Czaja et al., 2019, p. 55). The absence of contact and experience influences their use.

In short, it is not merely aging-related factors that are related to the acceptance of the technology, but also individual factors such as lifestyle, geographical location, type of technology and learning

## 5. USABILITY AND UX DESIGN

For the designer it is important to adopt an approach based on the user's needs, namely their characteristics and barriers, their motivations for using the technology and the benefits it can provide. It is necessary to take into consideration the user's needs in order to find motivations for the use of the technology. Knowledge of the characteristics and barriers of the user are, together with knowledge of the technological functioning, the basis for the creation and development of a functional product.

Bennett (1979) was the first to use the term "usability" to describe the effectiveness of human performance, and Shackel (1991) defined usability as "the ability to be used by humans easily and effectively" (cited by Galitz, 2007, p. 55). Galitz (2007) emphasizes the Human-Computer interaction relationship so that the main goal of the user is fulfilled, i.e., that a need is effectively met. Nielson (2012) adds that "usability is a quality attribute that evaluates the ease of use of user interfaces," and can be defined by five quality components: Learning, Efficiency, Memory, Errors, and Satisfaction. Usability and utility are also pertinent concepts. First, it will be necessary to determine whether something is really useful

and only later, whether it is easy to use or pleasant.

In the design of websites the problem of usability is a growing concern (Nielson, 2012). For example, in an e-commerce website, if the user cannot find the product, he cannot buy it, becoming a problem for the user and the company that sells that product. In a work context, if an employee fails to perform the task, he or she will feel frustrated and demotivated, damaging the company's productivity.

For the the design process, it is required that the designer understands the needs, the preferences, the skills, the motivations and eventually any limitations of the user. It is also not sufficient to understand the limitations and common characteristics of a group of users, but also mandatory to directly interact with the user.

## 6. DIGITAL INTERFACE DESIGN AND UI DESIGN

The interface corresponds to the elements of the machine or software where users interact, thus being able to see, hear, touch and talk. Galitz (2007) explains the interfaces according to two components: the "input" and the "output". The "input", corresponds to the medium the user uses to communicate his needs, for example: the touch screen, keyboard, mouse or voice. The "output" corresponds to the response of the machine to the user's stimulus, mostly the monitor screen or voice.

The Usability of Interfaces to a device (or technology system) represents a communication channel between the user and the product. Users, when interacting with a device, communicate via the interface via the system inputs and outputs. (Czaja et al., 2019)

*"The proper design of an interface will provide a combination of well-designed input and output mechanisms that meet the needs, capabilities and*



*limitations of the user in the most effective way."* (Galitz, 2007, p. 4)

In convergence with Galitz, Cooper et al. (2007) points out the importance of the designer in "(...) creating visual representations, which better communicate the specific behavior of the interactive product they are working on" (Cooper et al., 2007, p. 288) and adds: "the human brain is an excellent computer for processing patterns, giving meaning to the dense amounts of visual information that bombard us everywhere we look" (Cooper et al., 2007, p. 293).

The human-machine interaction is pointed out by the above-mentioned authors as a point of prominence. Digital interfaces, graphics and forms of interaction should always be considered by designers, since understanding the product and the way the user interacts with the machine is of great importance.

The work of the UI Design designer will be to make the interaction efficient and pleasant. The user experience (UX Design) is influenced by interface design choices. Interactions and design are not static elements, being influenced by the variation of technology systems, but also by the variations of their users. The variability of skills of the elderly age group, makes the designer's work constantly demanding and challenging.

## 7. THE PRODUCTS OF ICT4SILVER PROJECT

A set of three products that were part of the ICT4Silver project were selected for the analysis and improvement, namely: ArkeaOn-Life, PhysioSensing and Kwido. The criteria employed in the selection of these products included the level of maturity (TRL), and the degree of information available for the proposed study. ArkeaOnLife is a brand of Crédit Mutuel Arkéa, and it is devoted to connected living and home, enabling a more independent lifestyle by users in

their homes, or even users that are permanently committed to senior residences. The product is made available as a smart watch, and it allows alerting for emergency assistance, making emergency phone calls, and identifying the location of the user in need of help.

PhysioSensing is provided as a combination of (1) a portable platform for balance (and posture) assessment as well as mapping pressure (e.g. plantar pressure), and employs a tactile screen for interaction with the user, giving visual bio-feedback, and (2) specialized software, developed by the company, that performs the assessments as well as training sessions (through serious games).

Kwido is marketed in the form of a mobile application, allowing the user to share personal and clinical information with other important stakeholders, namely care companies, medical professionals, and any formal or informal caregivers.

In the ICT4Silver project, these products were tested with real users and under real conditions (in 3 distinct settings, namely users at home, senior residences, and rehabilitation centers). All tests were performed within caregiving entities that were either a formal entity of the ICT4Silver consortium or their partners, with the goal of identifying mechanisms to improve and accelerate the commercialization of these products.

### 7.1 PREVIOUS TESTING OF ICT4SILVER PRODUCTS

The tests carried out in France, Spain and Portugal on the products by the ICT4Silver consortium showed that they had great market potential, in particular because they met the real needs of users. However, the products still revealed several problems, which were analysed in this study. The ArkeOnLife product was evaluated by users as being very useful, adding the potential for safety and peace of mind for users and carers. This product also provides greater independence to

the elderly.

In the PhysioSensing product, the tests carried out showed optimism and motivation, but were evaluated with a difficult degree of usability for the elderly. PhysioSensing is not intended for the elderly and has numerous barriers to use. The fact that the product is divided into two components, platform and screen, using and various cognitive, perceptive and motor skills, makes it difficult for the elderly to use it.

Kwido presented an insufficient response to the needs of professionals, not ensuring the safety they need. There was a lack of research on the real needs of its users, compromising the potential of the product. However, the product has generated enthusiasm in the users, proving that there is a need in the market.

In our analysis of these studies and tests carried out by the ICT4Silver consortium, we found that they were insufficient. For this reason, we consider it necessary to develop a more rigorous study on the usability of these products for senior users. In the following chapters we present a summary of the evaluation we have made and the proposals for improvement of these same

products.

## 7.2 ASSESSMENT OF PRODUCTS

ArkeaOnLife, PhysioSensing and Kwido products are presented by the ICT4Silver project as products with Silver Economy potential, i.e. they are products with potential use for the elderly group. However, these products had gaps in usability for the elderly public. In this sense, the main UX and UI Design problems of ArkeaOnLife, PhysioSensing and Kwido products were identified in order to study design solutions, which better correspond to the needs of the senior population.

The **ArkeaOnLife** product (Fig. 1) presents problems related to the physical product, but shows a very positive and satisfactory digital interface design. The ArkeaOnLife is a simple product, whose main goal is to help the elderly in preventing accidents, caused by malaise and fall. The interface has 4 screens: analog clock, alert (after pressing the red button), cancel alert and call for help.

In our analysis of this product, we have identified design and usability problems, namely the difficulty in reading letters and numbers and the ergonomics of the bracelet and outer buttons. It was also found that the smartwatch software is too complex; the battery life is low; and smartwatch does not have vibration functionality.



Fig. 1. ArkeaOnLife smartwatch.

The **PhysioSensing** (Fig. 2) is a product aimed at users of various ages, and has great application potential for the senior user. It is a product with two supports, platform and software for screen, which makes the process of use difficult. The software is also complex, making it difficult to use, even when used by professionals.

In the usability tests numerous difficulties were found, namely the use of the platform, the software and, above all, the interaction between both.

In the product several obstacles to its use by the elderly were verified, such as:

- motor difficulty, coordination, precision and strength;
- visual inability to understand the games;
- cognitive difficulty of attention, memory and above all reaction.

In a joint analysis with those responsible for “Sensing Future Technologies”, digital design intervention was proposed only in the product part. Specific screens of the Software were selected, considered with potential use for the elderly, in order to be analyzed and changed. These screens include a menu and its associated games.

In the analysis of problems based on PGD, the points related to vision, memory, attention and motor capacity are highlighted. The screens are presented with a large green spot (shortwave colour) without the use of contrasts. The graphics are exposed with very small dimensions and without highlighting the focus or action points. The nature of the games requires motor skill of coordination, perception and strength as well as attention and response. Such points were highlighted as being problematic in the product.

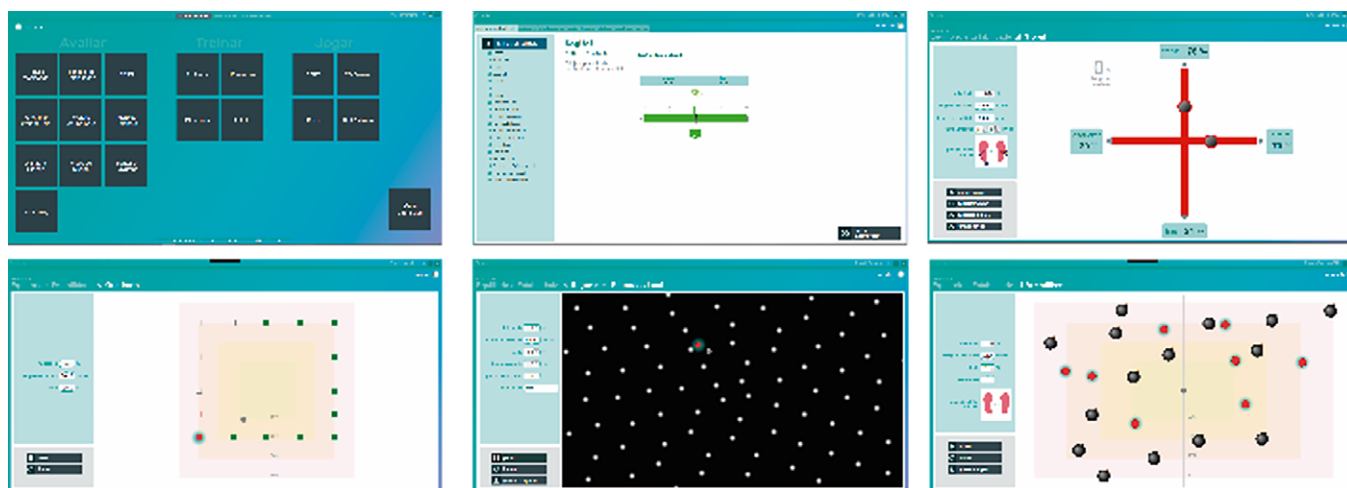


Fig. 2. PhysioSensing screens.

The **Kwido** (Fig. 3) is a platform with the main objective of improving the quality of life of the elderly, with content for various users: elderly, family, health care companies and doctors. The report of the usability tests to Kwido revealed difficulties of use by the various types of users. Elders and health professionals report that the product lacks objectivity, including content considered unnecessary. The difficulties in information architecture and the hierarchy of content and actions are also highlighted.

In the verification of the product, based on the DGP performed, problems in the consistency of the information architecture and the selection of contents are noted. The platform offers too much information, making it difficult for the user to pay attention and interest. The size of texts, icons and targets are too small, making them difficult to read. Problems are also pointed out in the writing of content, with language too technical for the elderly user and even for the family care provider.

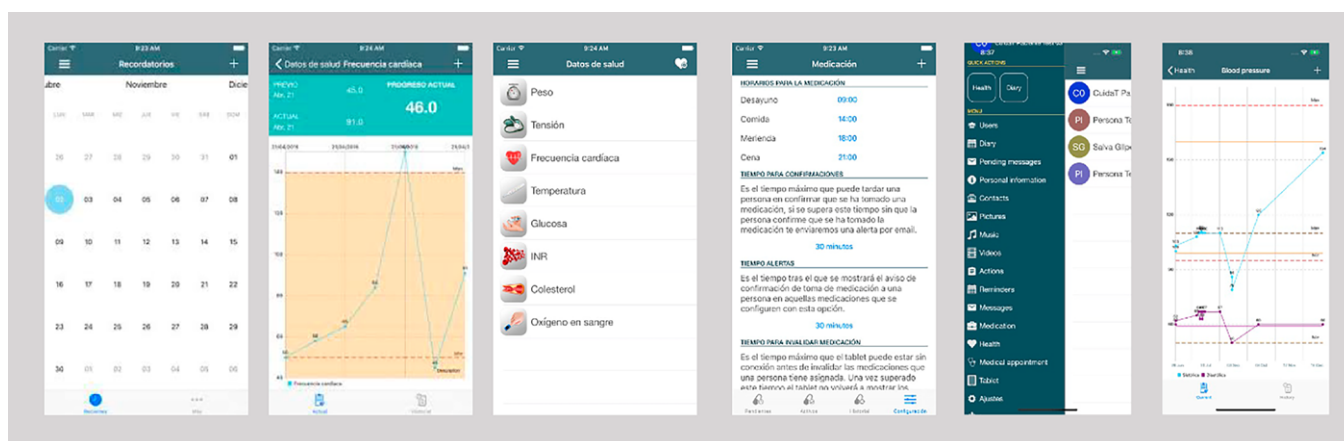


Fig. 3. Kwido screens.

## 8. REDESIGN OF ARKEAONLIFE, PHYSIOSENSING AND KWIDO PRODUCTS

For this work's development phase, a series of methods and strategies were employed, along the lines of work processes defined in *Agile Design* and *Design Thinking*, which aim to lead to product development with greater empathy and agility. The employed methodology aimed to allow an optimum level of interaction with the elderly.

A total of three of the *Lean* development phases were employed, namely: "thinking", "making" and

"testing". In the first of these stages, "thinking", the possible chances of development are structured (Gothelf, 2018). In the second stage, "making", a prototype is drawn up on the basis of the hypotheses. Finally, in the last stage, "testing", the proposal is provided to users (Fard, n.d.). Some of the elaborated considerations are presented in detail for each of the products under development. Such considerations are a selection of problems concerning the usability and design of the products, and subsequently, possible solutions.

In the case of **ArkeaOnLife** (Fig. 4) problems were identified such as the difficulty in reading the numbers, as well as the lack of information on the calendar and battery status. For the elderly, the information should be present in a very visible way to help them in reading and memory. In the elaboration of the new screens for the product, solutions were presented such as the addition of all the clock numbers and the creation of a second screen, with digital numbering and with calendar information and battery status. A third battery alert screen was also proposed.

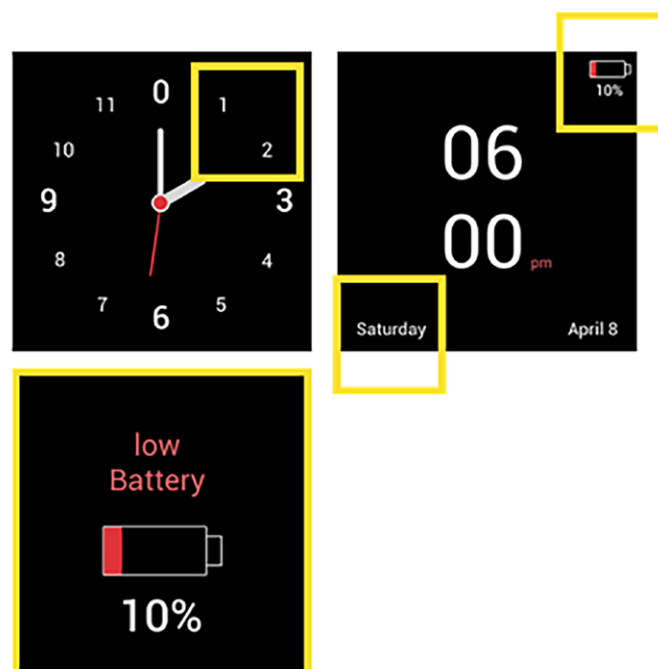


Fig. 4. New solutions for the ArkeaOnLife product.

In the case of **PhysioSensing**, the key issues identified in the study are the long menus without hierarchy and the difficulty to use interaction targets. The elderly has greater difficulty in concentration and visual selection, as well as motor difficulties in control, speed and direction. At the interface, the creation of menus with

hierarchies and no levels of interaction was suggested. *Touch targets* and *pointer targets* were also changed and adapted to the visual and motor characteristics of the user. To help the working memory a site map and related elements were proposed to navigate back easily. The absence of contrast and the use of short-wave colors such

as green and blue, also introduce difficulties. Thus, an accentuated contrast color palette was proposed in the redesigned interface. The creation of a fluid reading, using a constant and repetitive architecture (Fig. 5) is proposed in order to avoid the constant use of cognitive abilities, such as concentration and memory.

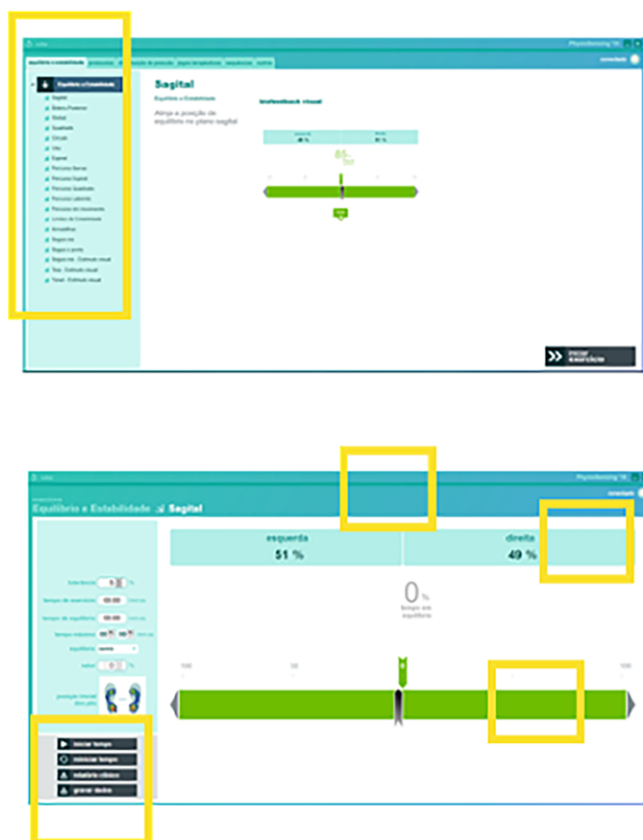


Fig. 5. PhysioSensing interface (left: original format; right: proposed redesign).

In the case of **Kwido** (Fig. 6), the main issue identified is the extensive menu of the main interface, with undirected and confusing contents. As a result, the different users (seniors, caregivers and health teams) found it difficult to locate the content aimed at them. In this product, an initial menu was thus created in order to organise the contents by type of user. Kwido also presents



problems such as the excess of content, making it difficult to concentrate and navigate fluidly; and targets of interaction with elements are too small and lacking in contrast and white space, which is reflected in a disorderly and hierarchical

application. As a solution, the simplification of information was proposed, incorporating targeted content, buttons with appropriate dimensions and white space with hierarchies and contrast.

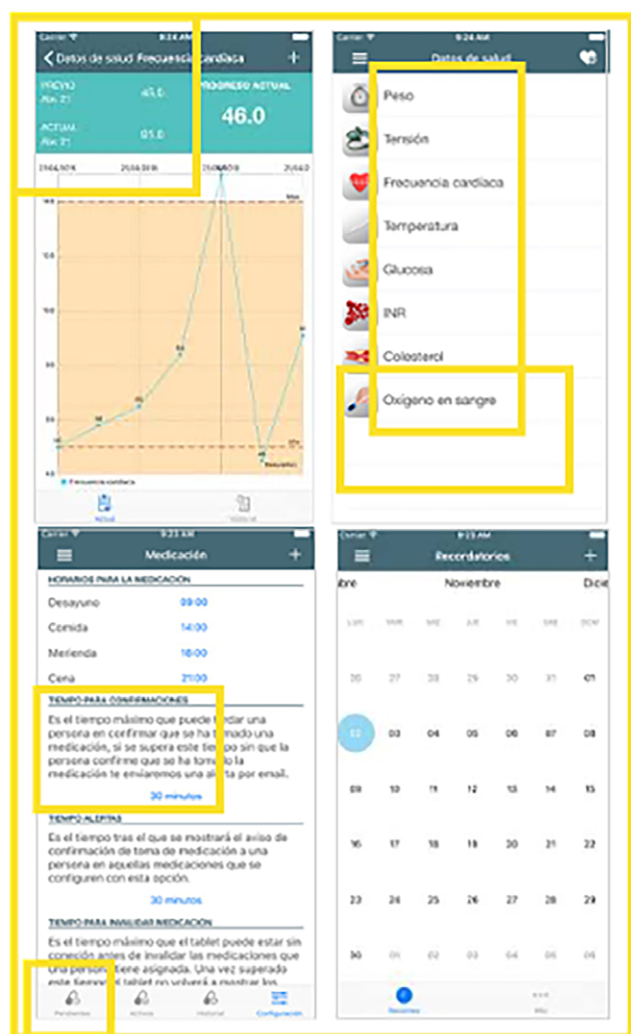


Fig. 6. Kvido interface (on the left: original format; on the right: proposed redesign).

## 9. CONCLUSION

This study aimed to define the basis of design in the construction of a digital product that meets



the current needs of the elderly population. Currently, there are many high potential technological products on the market that do not truly consider both the physical as well as the psychological characteristics and limitations of the elderly. As this population segment is expected to continuously increase with respect to the overall population, there is clearly an urgent need to create and adapt technological products for the elderly. Thus, through this research and the proposed solutions, it is intended not only to define guidelines aimed at the senior population, but also to raise designers' awareness in the development of products with inclusivity concerns.

Finally, it is also pertinent to note that this work is intended to raise awareness and create inclusive technological solutions for the senior population, as increasing the interest and purchase of ICT products may form an important contribution to the development of Silver Economy.

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# The Role of Designer at Low-Code Product development process

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## Abstract

While designing a digital product, designers are asked to define experiences both at functional part as well as the visual deliverable, which defines the “tactile” experience. That visual solution results from a combination of usability principles, empirical knowledge from previous projects and research. These solutions are represented through workflow behaviour and selected UI patterns. Patterns are standardized representations that helps both designers, business analysts and developers to create a systematic approach to product development by increasing efficiency, reducing re-work and, decreasing time to market delivery. From the users perspective helps to easily recall micro-workflow behaviour and create quickly engagement and awareness to products. These approach to product design based on atomic design principles, is aggregated into a design system which constitutes the baseline of work to all team involved. Technologies like Oracle Forms, Microsoft Silverlight, Visual Basic, etc had, already in the 80's, provided to developers closed UI libraries to enable the creation of interfaces. Those libraries were created to help developers to release quickly functional interfaces with no need of designers intervention. Nowadays, with web based (HTML) and native apps new possibilities and challenges, even more proficient and demanding users, pushed technology providers to increase their investment into creating UI patterns (both mobile and web) that would constitute a better baseline of work to developers, in order to meet designers solutions and to reduce development delivery time. Low-code, which are product development accelerators that provide to developers ready-to-use assets that enable fast delivery. Low-code providers like Outsystems or Mendix are increasingly including in their releases evolutions to their own design systems (themes, good practices and UI patterns). In our paper, we intend to discuss the advantages and disadvantages of the articulation between design and low-code technologies in digital product development process, based on Outsystems Silk UI system. How can designers benefit from this new quality assets? What is the customization capability where designers can operate? Which challenges does this bring to designers, as visual representations are being improved by technology providers and designers can focus their work into the intangible part of the designing process? Exploring more closely analytical areas to improve user- experience design, helping to design models to show and manipulate data to create better and faster analysis (areas like machine learning, AI, data scientist) raises the question of if low-code can also be an accelerator to design become more analytical?

## Keywords:

Product Designer, Digital, Development Process

# From a product designer to a (digital) product designer

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## Abstract

As a product design student we were taught how to approach problems, how to identify them, understand context, know the users and see how they interact with the system around and the relation established between them. After this research part, some questions arose, how to create a concept around the proposals, defend them and then define a final solution that would embody in the best way the identified user needs? The context's requirements bring some innovation to the field and how to make it easy to use a system to allow an easy reproduction to the industrial stakeholders involved. These kind of projects allowed me to understand the project methodology, to explore each step and define the correlation between different phases and how to apply divergent and convergent thinking along the way and, in this context, already trying to, in the best way I knew, to orientate the process into efficiency in order to achieve the best results in the shortest time. Well, and then came the labour market. For the past (almost) 6 years working as a designer, with many names along the way: firstly as a product designer at an interior design & architecture studio, then graphic designer and UI & UX designer at a portuguese IT company developing digital products for healthcare and now as product designer (again) at an IT consulting multinational. The different projects I have been involved in, showed me the constant evolution that the designer have been passing. Designers have been gaining, in a consistent way, a huge space inside teams and consequently companies. When I started as a product designer, the "space" I was expecting to occupy in a team was directly related with the tangible parts of the product (co)creation process. The "space" that a (digital) product designer occupies nowadays starts at the intangible part of the process. The designer should also be responsible to define the system/service that incorporates the product(s) and well as being involved at the processes definition in order to include design and design activities at the development process. Being a digital product designer is an "umbrella" activity: from business analysis to prototype creation, producing documentation, iterating with internal team and clients, helping the development team through the sprints, assuring quality delivery by testing and designing training sessions and documentation for the client and users. As the product gatekeeper, the designer's intent is in the first place to bring to the client and the end-users the best solution that met user's needs. To achieve this primary goal it is also necessary to bring the best compromise solutions to all the project's constraints and stakeholders. It is all about establishing priorities and knowing the issues, that makes the difference and are worth fighting for and the ones that are very important but nice to have. In an industry where processes are developer-task-oriented (Waterfall, Agile, Lean), technology, budget and time constraints shape the product delivery, the real challenge is to find strategies to cope with all these daily challenges and contribute to the continuous evolution of the design role in the industry, by

bringing effective added value to solutions and creating constructive and positive dialogue in between teams.

**Keywords:**

**Digital Product Design, Product Development, Low Code, Patterns, Outsystems**

# Selection of a Graph for Studies on Information Visualization and Colour Vision Deficiency



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## Abstract

With the increased use of the internet in recent years, Information Visualization (IV) has become one of the key issues when communicating findings or data. Its main goal is to visually represent, as well as present information efficiently and effectively in order to be perceived and understood by all types of users. However, among the world's population (approximately 7.6 billion people), circa 4.5% (10% male and 1% female) of the population has some kind of colour vision deficiency (CVD). This means that 760.000.000 people struggle with this condition every day. This is a very big and relevant number that cannot be ignored. If following these numbers, and taking into consideration the number of internet users in the world, we can conclude that from the 4.156.932.140 active internet users, 415.693.214 of them are very likely to suffer from CVD. Therefore, these 415 million users won't perceive information correctly if not taken into consideration during the design process, one reason why designing for inclusivity is very important. In the field of Information Design, studies indicate that the perception of such graphs is also conditioned by their increasing complexity. The amount of information and the way they are designed is also a determining factor to their legibility. Overlapping information for better visual and graphic aesthetics poses even more problems to CVD users. In this context, this paper discusses the main findings gathered regarding an exploratory pilot study whose main objectives were two-folded: 1) to evaluate usability issues (such as cognitive complexity, spatial organization, information decoding, state transition, among others) regarding the visualization of four specific graphs; and 2) to provide a framework with which to discern among these four graphs, the one that was more difficult to perceive and understand. Using a sample of twenty-three users, both quantitative and qualitative measurements were gathered, via an online questionnaire, which fostered an accurate typological selection. Such a study was developed within the scope of a larger experimental research project which proposes to analyze and comprehend to what extent trichromatic users' perception of colours differ to that of CVD users.

## Keywords:

Colour, Information Visualization, Colour Vision Deficiency, Usability, Perception



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# Remote user research in longitudinal studies – Sharing past experiences and a case study with a nutrition-related system



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## Abstract

Although longitudinal studies can be an invaluable instrument to evaluate and understand how products behave on the real-world, they require a tremendous effort from the researchers involved in these studies. To address the challenges of implementing longitudinal studies in a real-world-scenario, the goal of this presentation is twofold: First, to share our practical experience and offer strategies to overcome the everyday problems of managing this type of studies. Second, to present our approach and tools to the management and analysis of participants' data and how to monitor participants across longitudinal studies.

While the literature already discusses the planning and recruitment of participants (Thomson & Holland, 2003), there is not much work addressing the practical experience of dealing with the everyday challenges of a longitudinal study. From the planning of the study to the analysis of data, constant obstacles can surface during the implementation of a longitudinal study. Recruiting participants is a demanding endeavor, as well as keeping them engaged during the duration of the study in order to improve participants' retention. Even the afterlife of the study needs to be considered, given the impact it might have on participants who have to return the technology back. Unfortunately, a significant part of this tacit knowledge just lies on researchers who have accumulated it through the hands-on experience in the field (Vasconcelos, Lopes, Ribeiro, & Correia de Barros, 2019). Moreover, modern systems and devices can easily generate large amounts of users' data, especially when sensor data is involved. What to collect? How and how much to collect? How intrusive do we want to be? These are questions that we need to answer. Different types of data can be collected, from passive data collected from the interaction of users with the system, to explicitly data collected through questionnaires or other user prompts. There is a fine balance between not collecting enough and missing valuable insights. Or collecting too much and being flooded with an incomprehensible amount of data, and risk turning away our participants. Even when a data collection strategy is implemented, it is hard to keep track of how well participants are doing, to know if, and how, participants are using the system, or which features are more frequently used. Following up on them every day is not practical, so

it can take a long time to notice problems with the system or with participants' engagement. Moreover, there is not always a simple way to make sense of users' data. Data might be available, but there is no way to visualise it. To address these problems, we have been developing a tool to help researchers visualize, in real-time, how people are using the product that is being tested. To check which features are used more frequently or how engaged participants are with the product. Through this web platform one can easily monitor remotely the overall usage of a product and get insight regarding how the system is being experience by participants during the study.

**Keywords:**

**Longitudinal studies, Remote user research, Data visualisation**

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# Track

## Design for Health and Wellbeing

*Challenges in design for health and wellbeing are related to becoming acquainted with the culture of clinical practice, research and standards, conducting fieldwork and addressing vulnerable user groups. This track welcomes contributions addressing i) case studies, ii) challenges and lessons learned from the field, iii) design research methods, iv) user studies and knowledge production practices, v) the relationship between design and health research and industry, vi) how to accelerate the translation of knowledge into industry, and vii) analysis of literature in the field.*

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# Response-able Design Research: Inviting, Visualizing and Sharing Responses in an Immigrant Youth Club and in a Social Café for Elderly

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## Abstract

Setting of in two specific field engagements this research paper seeks to highlight what field engagement might look like in a design research setting. We will here focus on two groups that may be perceived a vulnerable, since this track “Design for health and wellbeing” had a call for “conducting fieldwork and addressing vulnerable usergroups” ([www.senses2019.unidcom-iade.pt](http://www.senses2019.unidcom-iade.pt)). However, an important aspect of the paper is to show how binary positions such as “vulnerable/resourceful”, and the overall subject/object relation between researcher and researched can be challenged through feminist theory and visual and participatory methods. We explore both engagements through the feminist concepts of Response-ability (Haraway 2008, Barad 2012) and Diffraction (Haraway 1997, Barad 2007, 2014) and theory related to the transformative potentials of visual practice (Cox et. al. 2014, Loewenthal 2013, Wang and Burris 1994).

## Keywords:

visual methods, co-design, response-ability, diffraction, care

## INTRODUCTION

The first engagement takes place in a youth club for immigrant girls. Here the becoming of identities through images is explored through photographic and designerly program-experiments (Brandt et al. 2010, Binder et. al 2006). In the first engagement situated in a club for young immigrant girls, a co-designed photobook is explored as an experimental space for dialogue, intra-action and redistribution of research. The second field engagement sets of in a social café for elderly people seeking social relations. Here workshops were conducted exploring design methods and visual practice as tools for prompting and materializing life stories and memories, and supporting participants' sense of community and care.

## ENGAGEMENT 1: IMMIGRANT GIRLS' CLUB

We will start by presenting a photobook made during a photographic field engagement made by one of the authors (Lene Hald) with a group of young immigrant girls in Copenhagen, DK between 2014-2017. The girls were invited to participate in various visual experiments concerning the becoming of identity through images. The aim was to seek out new spaces for photographic and designerly engagement and explore what kind of agencies this might support. 12 different girls age 14-18 were engaged in producing images. Participation was voluntary for the girls, and no ECTS points, academic credits or degrees were awarded. The girls could join and leave the engagement as they pleased.

During this project various participatory and

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1 From the call for proposals for the "Design for Health and Wellbeing" track, UNIDCOM/IADE International Conference Senses & Sensibility 2019

photographic design experiments unfolded: The girls were photographed, and we discussed what immediate feelings and thoughts these portraitures awoke in them; they were invited to rework these images, by writing on them and crossing out parts they did not like; the girls responded to assignments put out; we discussed their everyday smartphone images; we made small films together; and also two exhibitions came out of the engagement: One exhibition in the girls club, and one exhibition during a Photo Festival.

The photographic design experiment we will talk about in this paper concerns the making of a photobook for and with one of the participating girls. We find that the photobook works as an example of how an entangled participatory process can be materialized into concrete and aesthetic matter that opens up new spaces for dialogue. The photobook was a way of diffracting concrete materials from the research plus theoretical aspects of the research process through one-another, with and for the participant.

The idea of the co-designed photobook grew out of an interview made with one of the girls about the many selfies most participants took on their phones on a daily basis. Selfie-takers are often (in popular understandings) called out for being vain and self-absorbed (Burns 2015) however, this participant carefully pointed out that her purpose was quite different from any narcissistic teenage practice concerned with reproducing conventional beauty ideals. When asked asked about why this specific participant took so many selfies, her answer came promptly: She wanted to make photos for her (unborn) daughter. As she explained "....I can show it to my daughter, and I will say 'look [this is.] your mother [this is]

how I was'..." Her response might have excluded a cacophony of other entangled, conscious and unconscious reasons for her selfie-practice that she did not feel the need to articulate in the moment. However, her immediate response to the question seemed filled with meaning. The idea of taking selfies in the present as preparation for a future self (or to be exact: taking them for the imaginary daughter of a future self) seemed important for several reasons: First, it showed how the invisible and the imaginary are to be viewed as mattering forces when exploring the becoming of identities – as well as the importance of diffractively reading future dreams and fiction into the apparatus of subject production and the enactment of visual mattering (Højgaard & Søndergaard 2009). It prompted the idea that we could make a book for her daughter consisting of her selfies, diffracted through other images related to her past, present and future: "To address the past (and future), to speak with ghosts, is not to entertain or reconstruct some narrative of the way it was, but to respond, to be responsible, to take responsibility for that which we inherit (from the past and the future)" (Karen Barad, 2010). Her intention for making these selfies was to keep an archive of how she "was" for the daughter she might have in a near or distant future. We agreed to materialize this idea into a photobook.

## RESPONSE-ABILITY

Making this book was a way of taking a participant response seriously. In this way the book opened up for dialogue and response-ability. It was an attempt to design and produce something for and with the participant that she genuinely wanted– a participatory based product of our engagement/ intra action, and the participant seemed genuinely enthusiastic about the concrete idea of co-producing a photobook for her

(unborn) daughter. Furthermore, it was a way of acknowledging the visual skills of the participants and her production of selfies. Including her selfies was a way of pointing to how selfie-takers are skilled practitioners; skilled visions are required in order to know how to pose, photograph, post, and draw most likes or shares. To the untrained eye, any selfie might look very similar to the next. However, subtle variations, details, and nuances are important. The participant explained what constitutes a good selfie: "I know when it is good the picture when it is not so blurry and it is not shaking and you can see really the face and maybe I smile and not like a (...) dumb, like stupid face. And also the light is really important." She used a specific series of selfies to let me understand what kind of skilled visions were needed. "... this one is not good because the hand is not supposed to be there" (referring to how her arm was positioned) "... here you can see that the phone is like (tilted) this so it is not so straight the face" (referring to the camera angle). In another selfie she noted that "... here the lighting is really blue. I took the wrong effect and I can't change it. And actually this was my only one favorite because you can see the necklace and also my earrings makes a special detail." (Interview with participant 17/1-17).

## DIFFRACTION

The photobook was an attempt to exemplify how the concepts of diffraction can contribute to understandings around participatory practices and processes. We used the feminist concept of diffraction to challenge binary subject positions such as vulnerable-ressourceful and researcher-participant. Concretely we combined a selection of the many selfies with researcher-driven portraits. Placing participant selfies and portraits made by the researcher together in the same booklet was a way of encouraging a diffractive reading of our images through one another to



hopefully bring about creative and unexpected outcomes, providing a space for thinking about how our specific skilled visions - our expert knowledge - makes a difference.

According to classical physics, diffraction is a physical phenomenon that comes into being when waves encounter an obstacle upon their path, and/or when waves themselves overlap. Within feminist theory, diffraction is used to trouble the concepts of opposition and separation. Diffraction is about passing apparently separate things through each other, exploring how they intra-act, how they are mutually produced by each other, and what difference this joint production make. Feminist theorist and quantum physicist Karen Barad pushes the optical metaphor of diffraction as a methodology to think with and through (2007, 2014). As she puts it, diffraction “troubles the very notion of dicho-tomy – cutting into two – as a singular act of absolute differentiation, fracturing this from that, now from then” (Barad 2014: 168). Diffraction has been a guiding concept for how the photobook was put together. A diffractive way of mattering – using overlays of researcher and participant generated material, biographical materials, hybrid collages, (super) positions and the photobook as a site for multiple experiences and entangled tales.

## ENGAGEMENT 2: A SOCIAL CAFÉ FOR ELDERLY

Now we will shortly point to how we sought out to expand this approach of working with visual memory books to a social café for elderly. During the summer of 2018 we set up memory-book workshops at Paraplyen(The Umbrella), a social café for elders in Copenhagen, Denmark. Participants were invited to take part in various visual experiments meant to prompt conversation around life stories, while simultaneously create

artwork for a memory-book. The workshops were framed as spaces for dialogue and creation of personal memory books. The aim was to seek out new spaces for reflecting on the lives of the participants, setting of in small visual tasks. Here we worked with a designerly tool box, which sought out to prompt creative ideas. The project was formed from the idea that visual methods are valuable when working with delicate themes that are likely to elicit emotions that cannot promptly be expressed in words, as “visual methods such as photographs and drawings may enable participants to begin to articulate what otherwise may be unsayable” (Cox et. al, 2014: 4). The healing potential of expressing the unsayable through aesthetic and visual means is explored through the genres of photovoice (Wang & Burris 1994) and phototherapy (Loewenthal 2013) inviting people who were previously “subjects” to become co-creators.

### VISUAL SOCIAL RESEARCH AND DESIGNERLY FIELD ENGAGEMENT

We believe approaches such as photovoice and therapeutic photography are relevant for design researchers interested in enabling participant responses through visual storytelling. Photovoice was first introduced as Photo novella by Wang & Burris in 1994, and this practice has since become an established methodology that allows individuals to reflect upon the strengths and concerns of their community, in an effort to bring about positive social change by providing photographic training to participants, so that they can advocate for themselves and improve the quality of their lives. The practice has been applied in various projects from dealing with homeless people to refugees, to people with diseases (Harper 2012).

Phototherapy and therapeutic photography, in Jo Spence’s words, quite literally means

“using photography to heal ourselves” (Spence 1986:156). Through insights gained through such visual approaches we might enable research participants to gain new levels of self-awareness about their lives and feelings “in a way that offers routes to interiority that allows the shifting, contingent and transformative nature of the self to become known to the ethnographer and/ or to be represented through alternative narrative forms” (Hogan and Pink, 2012: 243).

It seems important to emphasize the value of such visual methods within designerly field engagement, since design can be understood (and has traditionally been understood) as a very visual practice. Design disciplines have, throughout their histories, actively engaged with visual methods; most designers and design students will as part of their design training learn sketching techniques, be introduced to photography, illustration, mood boards, collage-making, croquis drawing, and visual digital tools, like Adobe Photoshop, Illustrator and InDesign. The use of visual methods is an integrated part of generative embodied design history, designers are programmed to use visual methods as working tools for anchoring knowledge in poetic and practical ways. For example, Prasad Boradkar writes that, “ The creation of aesthetically appealing artifacts is often described as one of design’s primary goals and, therefore, the research that is conducted in the design disciplines includes several visual methods. These typically include photography, videography, sketching, diagramming, storyboard ing, model-making, prototyping and so on.” (Boradkar 2010: 150). Many designers will find working with images natural, whereas they might struggle with the constraints and formalities of writing. As a result of this training, design students cultivate their visual literacy in a way that will most likely make them “care about the image” in a way that Darren Newbury provocatively argues scholars within the field

of visual social research have not fully yet learned (Newbury 2010: 651). The visual is often mentioned as a designerly competency. Thus, the materiality of visual production and designerly practices seems to be immensely entangled. Hence it seems productive to apply these skilled visions in relation to designerly engagement with what may be perceived as vulnerable user groups.

## EXHIBITION EVENTS

Both engagements included exhibition events. In both cases we wanted to close the project and our collaborative work in a way that would seriously present our engagement and the visual work that had been produced as a result of that engagement. In this way the participants could experiences the fruit of our work in a formal exhibition. In the same way it was a way of enabling further response from them in relation to what had happened between us during the process.

### EXHIBITION EVENT IN RELATION TO THE PHOTO BOOK/ ENGAGEMENT 1

Regarding the first engagement in an immigrant youth club, the photobook project was presented in May 2017 by the participating girls and researcher through an exhibition and a talk held at a Photo Festival. The event was open for all and had been announced through the official program of the Photo Festival.

Including the participant in a talk in relation to the exhibition was a way of questioning the idea that representations are presumed to serve a mediating function between independently existing entities. I did not want to present the research and our images by proxy (as in this paper). It was a way of bridging the gap between the person represented and the representation of

that person. She was there in person, rather than me acting as a representative of her. Secondly, it was about publically engaging in a dialogue about the work we had done through the course of this project, specifically focusing on certain spreads and images in the book.

During the preparation for the event, we contemplated how to showcase this book. The active participation of one of the research participants challenged traditional roles; the participant was both co-researcher, co-photographer, but also research audience. Moreover, the role of the book was challenged: the book was at once for the participant and for the participant c/o her daughter (c/o as a signifier of how the book is given to her to “care of” before she (potentially) hands it over to her daughter). The book was in that way private, yet the book will also be partly published as research and the images in the book will furthermore work as aesthetic artefacts, and be showcased at academic and arts-based exhibitions. The context for and intention of the book is, in other words, fluid.

We tend to consider research to be fixed, assuming that any variations in the text of a work should be stabilized, reduced, eliminated, as if the establishment of an authoritative or definitive text will enable some sort of (fictive) control (Bryant 2002). However, by including the her book for her daughter in both public and private contexts, in exhibitions and for a family sphere, in a research context as well as within art institutions, we point in another direction; to the “text” as fluid, and dissemination as flowing. The book comes to matter in different ways that are constituted through these various entanglements (institutions and discourses emerging around it). What the photobook means will vary tremendously depending on when, how and where it is on display, who makes up the audience and the

occasion. In this way the book exemplifies how we might cut and bind processual research together.

We I decided to frame selected spreads, and images so that the participant could make her own cut and know exactly what would be shown. In that way, the book was not for everybody to see, but it was there as a framed cut, a bounded meeting.



Figure 1 (left). Preparing for the photo festival exhibition



Figure 2: Chosen spread from the booklet framed for exhibition during the Photo Festival

## EXHIBITION EVENT IN RELATION TO THE SOCIAL CAFÉ WORKSHOP / ENGAGEMENT 2

In June 2018 we did a smaller exhibition in the social café Paraplyen/the Umbrella. The exhibition here differed, since the focus here was not a public circulation of the images, but about creating a sense of community through visual and verbal storytelling within the social café.

Writer Michael Jackson reminds us that storytelling is also a way of participating in the world by creating a sense of belonging and reasserting dignity and self-respect when one becomes uprooted and displaced. He writes, “To reconstitute events in a story is no longer to live those events in passivity, but to actively rework them, both in dialogue with others and within one’s own imagination” (Jackson, 2002: 36).

Present were participants from the social café, the daily leader, and the users and volunteers that were present this specific evening. We wanted to highlight the project as a cohesive one, which was both concerned about the process that had brought the images into being, as well as the final visuals hanging on the wall.

## CONCLUSION

In this In this paper we have sought out the concepts of diffraction, response-ability and skilled visions in relation to various aspects of designerly field engagement. This has been an attempt to trouble the dichotomy of vulnerable-resourceful and researcher-participant positions. We propose that through the concept of diffraction we can expand reflective participatory design practices in horizontal ways, enabling the agencies of different skilled visions and

positions to interfere with each other and, and in so doing, open up spaces for new dialogues to emerge. As a way of opening up this in-between, the visual has mattered. Hence, we argue that we as design researchers must embrace the foundational understanding of visual expression so deeply embedded in design practices. These engagements seek to bring forth the tacit visual skills of the participants through visual storytelling. They furthermore seek to exemplify different ways of mobilizing and engaging participants through practices where responses are genuinely intra-acted with.

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# Paediatric to adult healthcare: A user-centered design perspective

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## Abstract

The aim of this research is to assess the barriers and issues when transitioning into adult care for adolescents with Juvenile Idiopathic Arthritis. Almost one-half of adolescents do not make a successful transfer to adult care as there is a lack of knowledge regarding the individual needs of the adolescent that exists among healthcare professionals. Health care transition is the process of moving from paediatric to adult models of healthcare. There are substantial differences between the adult and paediatric health care models, which may affect adherence by young adults with chronic diseases. Through a user-centered research design (UCD) and patient and public involvement (PPI) approach the needs of all participants and stakeholders will be assessed. This paper applies the most appropriate solution in tangent with the needs and feedback identified during the research process. This research acknowledges the opinions of all stakeholders in how the future of the transition process will be accomplished. In order to improve the process for the adolescent and other stakeholders during transitioning, these barriers and issues which hinder a successful transition need to be addressed. Barriers and issues have been identified to a successful transition that could be addressed through a UCD and PPI approach to improve the process.

## Keywords:

Transition of Care, Design for Health, User-centered Design, JIA, Patient and Public Involvement.



## INTRODUCTION

Despite research to date on the transition of care from paediatric to adult healthcare, adolescents are not transitioning smoothly into adult systems. Literature to date indicates the issues have been addressed primarily from a healthcare perspective. With this, it has been deemed that through the use of design research, UCD and PPI approach, the issues and barriers occurring during the transition process may be mitigated. Addressing the issues and barriers from a UCD and PPI approach involves the users at every step of the process, which may lead to more successful outcomes. The stakeholder groups will have an active investment in how the system runs and works while also having an active involvement in how the solutions are developed.

## JIA AND THE TRANSITION OF CARE

Juvenile Idiopathic Arthritis is the most prominent chronic inflammatory disease present before 16 years of age. Almost half of the adolescents suffering from JIA enter adult life with active disease (Lam et al., 2017). The management of JIA entails a treat to target strategy, that being, early diagnosis and the initiation of pharmacological treatment (Hinze et al., 2018). Consequently, there is a need for a successful transition from paediatric services into adult services in the treatment of JIA. The transitional requirements of chronically ill adolescents have been assessed in numerous studies (Conti et al., 2018).

Transitional care describes a service that aims to ease a move from paediatric to adult services (Campbell et al., 2016). Transitional care is the term used to describe services that strive to connect this gap in care. Transition is a planned and structured process involving medical, psychosocial, and educational

needs of adolescents moving from child to adult care. Often it has been expressed that adolescents and parents feel insufficiently prepared for the transition process (Raunsbæk et al., 2018).

During transitions of care, the lack of integration among various silos and inadequate communication between providers causes delays in delivering appropriate health care services to these vulnerable patients and their caregivers, diminishing positive health outcomes and driving costs ever higher (Clarke et al., 2017). Hence the need for more individualized and holistically based transition programs that cater to the individual needs of the adolescent and their support network.

A smooth transition from paediatric to adult care is recognized as a key factor in correctly managing childhood onset-chronic illness. There is data to say that mortality and morbidity rise after an insufficient transition from paediatrics to adult services (Conti et al., 2018). Young patients are predominantly susceptible and can experience worsening of their disease.

An unsuccessful transition from paediatric to adult services can risk delays and disconnection with healthcare practices for the adolescent, resulting in adverse outcomes in their care and poorer long-term health (Brooks et al., 2017). Similarly, an inadequate transition for adolescents with chronic illness has been related to an increased risk of non-adherence to medical treatment, and increased morbidity and mortality (Moynihan et al., 2015). Transition difficulties are undisputable for adolescents and can result in severe consequences when services fail them. Paediatric to adult healthcare transition can be especially difficult for these adolescents, as it occurs at a time in their lives when they are



already experiencing many lifestyle changes that are influenced by education and personal development (Vaks et al., 2016).

Many protocols, procedures, models of care exist worldwide, however, universal implementation has not been realized and unmet needs continue to be reported (Clemente et al., 2017). There have been various transition models and approaches evaluated and reported in literature (Campbell et al., 2016). Young people with rheumatic diseases in the UK recently reported transition as a research priority (Parsons et al., 2017), and whilst acknowledging the progress so far, there is much left to do. McDonagh (2017) has stated that future research will need to reflect both the multidimensional biopsychosocial aspects and the multiple systems and stakeholders. Only when these aspects of the research have been addressed it will be then that the aspects of transition readiness and service components influence which dimension will be known (McDonagh & Farre, 2018). Application of UCD and PPI processes permit the needs of all stakeholders who interact with the transition process to have their say in how the future of the system works.

## METHODS

The first step is a comprehensive literature review which presents an overview of the transition process and JIA, then narrowing in on issues that are felt by all stakeholders. Following on from this, a search is undertaken in design in healthcare and how the UCD and PPI could be the best applied approaches. As a research strategy, grounded theory offers many possibilities to the researcher as it allows the opportunity to generate “reality” and theory that emerges from the fieldwork. This ensures the research that is being conducted is not reinventing the wheel,

the study aims to contribute to the existing state of knowledge. Future planned studies for the development of this project will entail semi structured interviews with all stakeholders, focus groups and also the use of different design tools such as cultural probes. In tangent with design research methods such as immersion studies and ethnography. These methods have been selected to allow for the requirements of all stakeholder throughout the process to steer the path to a smooth transition process. Current research in the area of transitioning from paediatrics to adult care has been addressed primarily from a clinical perspective (Reed-Knight et al., 2014), thus deeming the research to be addressed from a design perspective through a UCD and PPI approach and identifying all needs of all the stakeholder may mitigate issues and barriers that exist.

## DESIGN FOR HEALTH

The fundamentals of design thinking are a systematic innovative process that highlight the importance of the end-users needs, desires, and challenges they face. One must begin with research and empathy with the people affected by and knowledgeable about the product, service, system, or experience that needs changing (Chapman, 2016). Developing solutions to the numerous multidimensional challenges facing the health of individuals and communities remains an arduous challenge in healthcare. Core methods in design thinking can differ between various authors and practitioners, the methods that are most widely accepted and that apply to healthcare administration are developing empathy, radical collaboration, and an iterative approach (Roberts et al., 2016).

Design and human behaviour are intrinsically linked (Deterding, 2015). The design of objects

and how services are configured all evoke particular ways of responding and behaving. Curiosity in this relationship between design and behaviour change has been evolving mainly in the context of the broader healthcare environments. This interest stems from a rising recognition that when certain behaviours have been adopted there has been an enhancement in health outcomes and quality of life (Alcorn & Broome, 2014).

Designing appropriate products and services for the outlined stakeholders requires deep unprejudiced understanding of their needs. One consensus across literature concerning methods in designing for adolescents is maintaining 'user centrality'. The user-centric design ethos suggests keeping users and key stakeholders central to research and included in methodologies (Norman, 2013). This is in contrast to designers having the sole responsibility of assuming what people require. UCD keeps focusing on the user throughout the design process with the view that this potentially links to better design output. There is growing evidence that designing health systems with the patient at the centre is an appropriate way to address the needs of people with chronic conditions (Harkness, 2005).

## USER-CENTERED DESIGN IN HEALTHCARE

Many studies have been performed to utilize UCD in the healthcare setting, however many they have not exploited the use of UCD to its full capabilities. From the study performed by Birnbaum (2015) regarding the necessity of patient engagement for the design of digital health. Digital health is an area of growing interest for physicians, patients, and technology companies equally. It assures the ability to engage patients in their care, before, during, and after an emergency department visit. Current efforts

to create, study and circulate digital health have been limited by a lack of user engagement (Birnbaum, 2015). Within this study, it can be seen that there was a lack of empathy for the patient needs as their opinions were not fully assessed in identifying these requirements. During this study the user was only included at various phases thus their needs were not accurately represented.

In the study conducted by Katsulis (2016) titled 'Iterative user centered design for development of a patient-centered fall prevention toolkit'. The UCD process was implemented, however, limitations did occur where the prototypes developed as solutions to the highlighted problems were final versions. This did not allow for the iterative nature of the UCD process to be fully explored and did not account for adequate feedback in the development of a possible solution (Katsulis, 2016). Therefore the UCD process was not entirely executed.

Patient decision aids, facilitate processes of shared decision-making between patients and their clinicians. This enables the presentation of applicable scientific information in balanced, logical ways, helping simplify patients' goals, and directing decision-making process. Although international standards stipulate that patients and clinicians should be immersed in decision aid development, little is known about how such involvement currently occurs, let alone best practices, furthermore it can also be seen from this that study no set of clear guidelines existed to implement best practices in UCD in the development of the study (Witteaman, 2015).

Patient and Public Involvement: (Hulshof et al.2019) identified that international populations are increasingly being summoned upon to participate in healthcare quality improvements. However, it remains unclear how involvement should be facilitated. In the UK patient and public involvement has become a policy prerequisite and

an official strategy to put patients at the core of quality care (Renedo, Marston, Spyridonidis, & Barlow, 2015). PPI is a successful method from the study conducted by Holmes (2019) the evaluation led them to believe that the usage of PPI working and model of professional practice allowed for a cycle of engagement. The patient and the public's involvement is successful in: adopting the forethought of making health research applicable and inclusive for everyone. Thus making the patient and the public more invested in how the health systems are shaped (Holmes et al., 2019).

Providing patient-centered care necessitates that patients partner in their personal health-care decisions to the full magnitude desired. There are differences between PPI the UCD processes. Public and Patient Involvement includes, 'public' anyone who has an interest in health and social care as a public services including prospective users of a service. 'Patients' refers to those who use the services such as patients, service users, clients or their carers. 'Involvement' considers the active involvement between people who use services, carers, the general public, and researchers. It does not include the use of people as participants in research or as research 'subjects' and does not provide data for individual research projects (Staniszewska, S., et al. 2017).

The user-centered design approach resides on the idea that a system, service, and or product prospectively satisfies user needs. The development process is built upon iterative cycles in which the potential user is involved and consulted early and often. This process includes people as active participants in the research and development progression during the project.

UCD is an established and verified approach used in the development of products, services, and systems (Abrams, Maloney-Krichmar, & Preece, 2004; Kelley, 2001; Norman, 2013). User-centered

design is a highly iterative process that is used for optimizing the user experience, consequently the effectiveness of a system, service, or product (Witteman et al., 2015). The 'user' is any person who interacts with the system, service, and or product for some rationale. PPI and UCD will be utilized for the purpose of this research ensuring all needs are being addressed. These processes enable all stakeholders to have an active involvement throughout the entire process.

## HEALTHCARE DESIGN MODELS

There has been an increase in attention to the potential design theory and practice can have in improving public health services (Hurley, 2016). Under the scope of UCD, experience-based co-design (EBCD) can be found, this is said to be a participatory research approach that merges design tools and thinking by bringing healthcare staff and the patients together to enhance the quality of care.

EBCD is an approach to improving healthcare services that combine participatory and user experience design tools and processes bringing about quality improvements. Through a 'co-design' process the approach entails staff, patients, and carers reflecting on their experiences of the services. They work together to identify improvement priorities, devising and implementing changes, and then jointly reflecting on their achievements (Fucile et al., 2017). EBCD is said to be a participatory research approach which ties design tools and thinking to amalgamate healthcare staff and patients together to improve quality in care (Donetto, Pierri, Tsianakas, & Robert, 2015). EBCD is a methodology that in recent years has been utilized for improvements in healthcare. The discipline lends itself to participatory and user experience design to bring about enhancements

in healthcare organizations. Through the process of 'co-design', EBCD require staff, patients and carers to think about their experiences of the services, work collectively to identify priority area to be improved (Donetto et al., 2015). Fucile (2017) conducted a study using EBCD to improve the patient and their families experiences in the Oncology Clinic in Ontario Canada, the outcomes of that study identified key 'touchpoints' to improve the cancer patient and their families interactions with the Oncology clinic. The results of the study gave the healthcare professional a true insight to the needs of the users of the systems. The study proved to be very successful to improve the patients', and their families' experiences of the system.

There are four overlapping trains of thought have contributed to the development of the EBCD approach, specifically: • participatory action research; • user-centered design; • learning theory; and • narrative-based approaches to change. UCD offers contribution to quality improvement thinking in the healthcare sector. This new model used to engage patients in healthcare improvements aids in mitigating the risk associated with UCD where there is a possibility that the patient may be the main focus of attention thus an EBCD approach account for the perspective of all stakeholders during the process holistically. Issues within healthcare are complex problems that consist of many layers. Research to date has been primarily driven from a clinical perspective, whilst a design approach allows for the research to be performed holistically, with a deep empathic understanding of the issues that are faced by all stakeholders. Integrating patient, and family member needs, wants and preferences in healthcare is of utmost importance. However, a standardized patient and family engagement model to understand these needs, wants, and preferences to translate into high-quality improvement activities is lacking.

## DISCUSSION

Many challenges exist in the transition process as previously mentioned. Adolescents is often referred to as a time of 'storm and stress' this adds to additional challenges, however, this allows for the role of design to have greater input on how these systems services and or products function. Many product systems and services within healthcare settings have been designed by experts for experts this can lead to these systems creating a daunting experience for the patient within healthcare settings (Reay, 2017). Through a well-executed UCD and PPI approach, the opportunity exists to develop a product or system service to ease the transition from paediatrics to adult health care.

UCD and PPI has been deemed to be the best approach to devise the most appropriate and user-friendly solutions for all stakeholders intertwined in the transition process. However, there are some challenges associated with the usage of the UCD approach for improving the transition from paediatrics to adult healthcare as all needs from all the stakeholders in the process must be carefully assessed to ensure the best and most appropriate solution is identified. This will mitigate against the possibility of a suboptimal solution being chosen. The iterative and holistic nature of the UCD allows for the development of the most appropriate solutions. All stakeholders will actively be involved throughout the research and design process to ensure their needs are being addressed. Persistent feedback and input from all stakeholder groups will true needs and wants are being addressed. Actively having the stakeholder groups involved throughout the process will engage the end users opinions to feel valued.

Progressively patients are becoming more

included in health research, not only as participants but as cohorts with valuable insights and perspectives. Patient partnership in research is becoming progressively urged (Witteman et al., 2015), therefore, understanding the needs, challenges, and obstacles faced by all through a deep sense of empathy will allow for best outcomes (Norman, 2013). A significant part of the UCD process is an account for real-world situations and context of use, or system processes. The UCD process engages the stakeholders often and early in the research and development of possible solutions. It permits all stakeholders to have an active input during all stages of the process allowing them more input in forward solutions. According to the ISO standard, a human-centered approach ensures that: (a) the design is based on an explicit understanding of the users, tasks and environments, (b) users are involved throughout the design and development, (c) the design is driven and refined by user-centered evaluation, (d) the process is iterative, (e) the design addresses the whole user experience, and (f) the design team includes multidisciplinary skills and perspectives ISO 9241-210, 2009, p. 5 (DIS, 2009).

In the previously mentioned studies where the UCD process was applied it is clear the process was not executed to its full potential. From this the purposed study aims to gain a greater understanding of all user needs. The mediums that are proposed to be used for the collection of data from all stakeholders are: Diaries, to track the emotional journeys of the stakeholders as they go through the transition process. Co-Design during the development of possible solutions thus allowing the stakeholders to have control in how the solutions are developed in line with their needs. The uniqueness of this approach allows the stakeholders to feel their opinions are truly valued in the development of a solution to mitigate the issues and barriers they have encountered during

the interactions with the current systems.

There are many benefits to the 'experience-based co-design' approach it is felt that a user-centric approach is a better fit as it has an empathic view of the issues that are faced by all stakeholders, and one may infer the issues and barriers that they face as these issues arise.

Empathy necessitates the researcher to listen vigilantly to all stakeholder needs. The opinions of all stakeholders are exceedingly valuable as they have indispensable knowledge of the current systems and where the barriers and issues occur. Stakeholders will have an active involvement during all stages of the project, where their needs identified during the data gathering process will be disseminated to all stakeholders. During the development of a possible solution, stakeholders will be consulted frequently to evaluate the solutions. Iterations will be encouraged based on their needs. UCD has been deemed to be primarily the most appropriate method as the nature of the selected topic is board and requires multidisciplinary approach.

## CONCLUSION

Traditionally health research has mainly been performed through quantitative methods, and due to the nature of quantitative data gathering, it is not very user-centric and does not allow for empathy of the system-users' wants and needs. therefore a user-centered design approach is regarded to be the most desirable method to be utilized to develop user-centric outcomes. Involving patients directly during the design process for creating more patient centric solutions may be a substantial development of their adherence to the process as they transition from paediatric to adult care and thus there may be less successful transitions reported. The user-

centered approach allows us to look at the system from a more holistic viewpoint. As previously stated healthcare is addressed in various silos and the user-centered design process will enable this issue to be possibly mitigated in the future.

It is important to know that while this research paper focuses on Adolescents with JIA and stakeholders involved in the transition process, we anticipate the outcome of the research to be more broadly implemented to other patient and stakeholder cohorts in the transition process and how the use of a user-centered design approach could be used to mitigate against some of the issues and barriers they face.

It is apparent from the literature that there is a lack of understanding of how the patient feels about the systems and services they interact with and it is hoped that this novel UCD approach can address the issues and barriers that JIA adolescents encounter.



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# Artificial senses and computer wearable design for health and wellness

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## Abstract

This paper shows some of the outcomes of the ongoing research on Design for wellness and for medical devices carried out at the Polytechnic University of Bari.

Particularly it focuses on the role of the ICT and the wearable technology in in the orthopedic field for the skeletal muscle strengthening and postural correction.

Proprioception and posture are strictly connected because the proprioceptive sensibility allows to be conscious about the position of the articulation and of the skeletal, the muscle tensions and the movement (Kinaesthesia).

Posture is the expression of an inherited experience (such as personal experience, training and physical and emotional trauma) and a rehab training, as far as a medical treatment, needs to focus the emotional sphere of the user – patient.

So, the question behind the research presented is: could ICT systems and the IOT address product design towards the definition of a new generation of interactive systems able to perform a postural positive rehabilitation and correction trough the enhancement of the proprioceptive sensitivity? Could design practices and methods help in a new vision for medical scientific frameworks in order to give a positive value to the medical treatment and rehabilitation experience focusing on the patient? Could the empowerment of the patient be enabled by IoT and smart devices?

In order to give an answer to that question the paper shows a meaningful selection of devices and technology in the state of the art and the results of the experimental phase: a smart lumbar belt and an app.

## Keywords:

**human center design, medical and wellbeing design, wearable technology**



this connection, the Gibson's theory on ecological perception is an excellent example. As is well known, according to Gibson proprioception should be conceived not as a specialized channel of sensations, but as "ego-reception", as "self-sensitivity". In this sense, Gibson writes, all perceptual systems are proprio-sensitive, but also foreign-sensitive, since all, in various ways, provide information on the activities of the observer (Gibson, 1966).

The physical activity aimed at skeletal muscle rehabilitation requires the constant presence of a specialist re-educator and the feedback of an orthopedic specialist in order to offer the best outcome. However, the dynamics between doctors and patients is changing according to World Health Organization. WHO defines empowerment as "a process through which people gain greater control over decisions and actions affecting their health"? The tendency is to the greater responsibility of the patient in the care and in assuming correct lifestyles (Kickbusch & Nutbeam, 1998).

Empowerment implies awareness and skills: in order to increase that kind of conditions this paper focuses on the state of the art in smart devices for wellness and proposes an experimental prototype of a smart lumbar belt.

### 1.2 RESEARCH QUESTIONS

Starting from this premise, the following main research questions are defined: can nowadays technology support the skeletal and muscles rehabilitation and the disease derived from the sedentary lifestyle or traumas, preventing the onset of posture-related pathologies connected with the back pain or/and controlling and monitoring them? Can sensors be considered sensory amplifiers useful for proprioceptive re-education? Can the persuasive role of the technology be encouraging the correct lifestyle enhancing the wellbeing? To the end, could the

Design practices and methodology centred on user-patient enhance a new vision based on the positive healthcare – rehabilitation experience? In order to give answers to that questions the research aims, on the one hand, at defining the state of the art in the design of intelligent devices in the wellness field and, on the other hand, at developing an experimental prototype of a smart belt for postural disease and rehabilitation.

### 1.3 ROLE OF ICT AND AI IN THE WELLNESS AND MEDICAL DESIGN FIELD

The design that uses advanced technology to improve the user experience places its methodological bases in the context of the human center design sharing knowledge and practices with the medical and Engineering scientific area (Chiapponi & Ciotti, 2016). The new class of high-tech artifacts recalls design to a direct dialogue with the sciences: as a result of rapid technological advancement, today we are witnessing an extreme fragmentation of processes and systems that requires an organic human centric vision. More than this, the holistic approach in Human center design (Chamberlan, 2008) ( due to the amount of data (big data) coming from user in the IOT environment can address a more defined definition of the user – patient, thanks to all that kind of information coming from the real interaction with the devices and the user questionnaire associated to the APP. This process, started with the digital revolution at the beginning of the 80's, has at the beginning introduced the concept of a class of artifacts intended as prosthesis of the human body, enabling the enhancement or replacement of the performance capabilities of the human body, through the so-called medical devices; today it is increasingly impacting the theme of customization, focusing on new performances that relate to the life style, artistic performance and the visual communication (Di Roma &

Scarcelli, 2016).

The miniaturization of technology (micro and nano electronics, nano materials) has, in fact, made possible the implementation of interaction and data exchange systems, able to interconnect man to machine, through clothing (Chiapponi, 2003). In the medical field, the application of sensors to devices was aimed at the development of “data receptors” able to communicate health status (heartbeat, blood pressure, insulin level, etc.). But the most interesting developments of the contemporary world lie in the possibility of managing input and output data by acting directly on digital information.

So, the premise for the development of this study is that the development of wearable technologies and IoT in the industrial product field can be a fertile field of experimentation in order to improve living standards. In fact, medical design aimed at the design of wearable devices, currently allows to examine in real time what could be the conditions of comfort and what could be the right supports, interactive or not, to propose to users in order to improve their well-being. The reporting of data framing the user’s medical parameters, if properly processed and addressed to wearable devices, can lead to the prevention of disease outbreaks and the improvement of lifestyles that include an adequate physical activity plan to be carried out. Ergonomics, well-being and comfort, properly parameterized and included as constraints of the design process, represent a real tool for innovation in the design of devices useful to meet the user’s needs. The research has required a transdisciplinary approach in which the design has operated a synthesis between the needs of the users, the instances coming from medical and physiotherapeutic sciences, the technologies implemented by computer engineering.

Design that exploits technologically advanced systems to improve the user experience lays its methodological foundations in the context of

systemic design and methodologically refers to human center design.

With reference to systemic design, Maldonado states that the designer, in addition to giving objects a shape, function and meaning, must have a broad knowledge of existing technology in order to improve the user’s living conditions (Maldonado, 1976). Chiapponi also argues that the designer’s role is becoming that of a problem finder, or rather a critical interpreter, capable of identifying the user’s needs (Chiapponi, 1992). Nowadays the informatic environment provides many opportunities to improve the quality of life in the ICT field: augmented reality, nanotechnology, smart materials, Internet of Things, wearable computer and wearable technology (McCann & Bryson, 2009).

This research considers, in particular, wearable devices, intelligent objects and textiles, which allow the creation of new products, services and interactions, designed for the sharing of information, knowledge and experiences through supports that provide stakeholders, through a smart interaction, the increase of physical and social awareness and the world around them. The use of smart technologies, in fact, allows to collect a huge amount of data and information about the user.

At this connection Norman summarizes three different types of design: industrial design, interaction design and user experience design. Industrial design deals with the creation and development of concepts and specifications to optimize the functionality, value and appearance of products and systems, to the mutual benefit of users and manufacturers. Interaction design, on the other hand, focuses on how people interact with technology. The aim is to improve their understanding of what can be done, what happens and what has just happened, based on psychological, technical and aesthetic principles. The design of the user experience, which deals with the design of products, processes, services



and environments, aiming above all at the quality and pleasantness of the overall experience (Norman, 2014).

So, the IoT, summarizes at best the new phase of artificial intelligence applied to objects and places. The term (IoT) refers to all those technologies that allow to connect to an Internet network any type of device. In essence, the purpose of this connection is to monitor, control and transfer information so that the appropriate actions can be taken. In recent years, the use of objects connected to the Internet has become increasingly widespread, both in people's daily lives (wearable devices, connected household appliances, etc.) and in work (digitized production

lines, Industry 4.0, etc.).

One of the key segments of this IoT revolution is precisely the industrial one, so much so that we specifically talk about Industrial IoT, which is nothing more than the application of the Internet of Things to the industrial world (Norman, 2013). Today, wearable computers represent the new world of electronic devices.

When worn directly by humans, they create the so-called human-machine interaction.

## 2. METHOD AND PHASE

Human centered approach – postural disease modelling

As this research investigated the boundary of design with medical - physiotherapeutic disciplines, computer engineering and materials technology, a multidisciplinary approach needed.

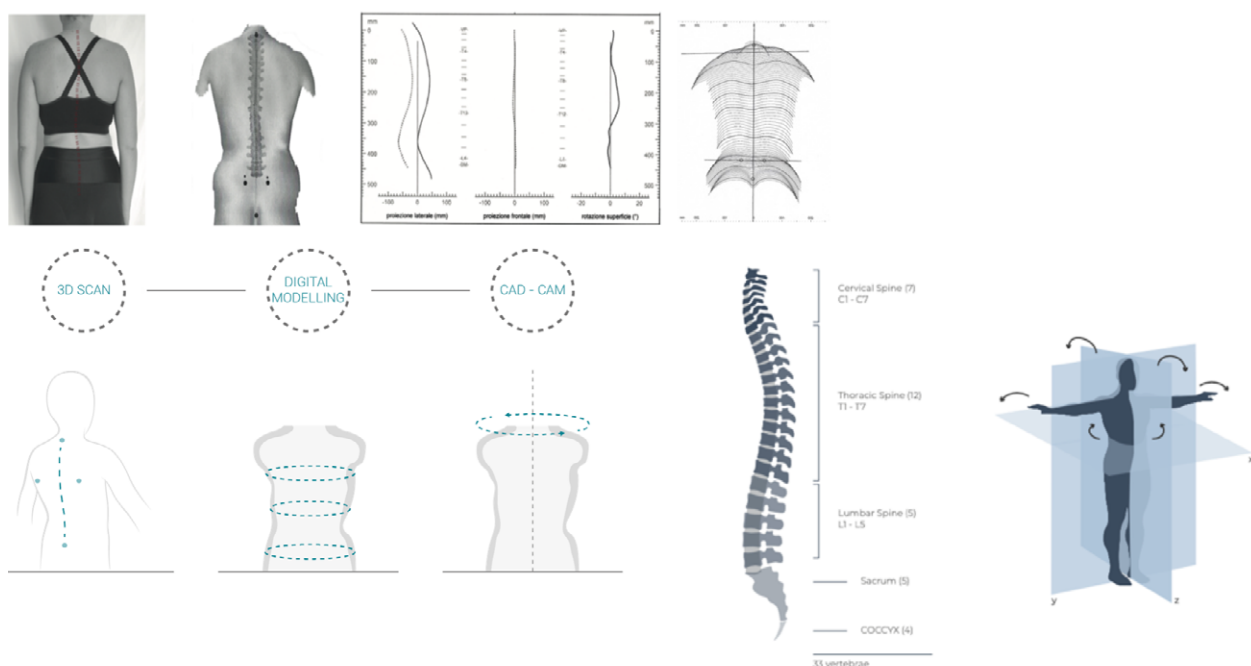


Fig. 2. In the postural correction, diagnostic and rehabilitative care, based on the spinometry and the rx ray, have been implemented by the systems based on laser scanning detection and cad cam

production. Starting from medical postural dysfunctions in real case study (Federica). In the first stage analysis it was performed on the assumption of repositioning of the sensors on the human body. The second phase includes the person's relief, the study of his posture and the reinterpretation of the human model. Finally, data overlap was performed to understand how to make them interact with the App.

In the tradition of the studies that are focused on person in the way in which “needs” are at the center of the Research action of Design. We have to state that this research is focused on Human Centre Design, more than on User Centre Design as far as Norman the methodological approach is not focused on “product” in itself with the necessary market implication, but it is based on the human interaction and experience (Norman, 2013), particularly in the postural disease rehabilitation.

As this premise has been done this study is based on an interdisciplinary team of researcher including orthopedic doctor and physiotherapist, as well as designers, informatic engineers, and material engineers. The medical diagnostic practice based on imaging techniques for posture correction was compared with reverse engineering techniques through laser scan and three-dimensional reconstruction of the musculoskeletal model, in order to identify the areas stressed during rehabilitation practice. If we examine the medical and physiotherapeutic field aimed at postural correction, diagnostics and rehabilitative care have implemented detection systems by laser scanning and CAD/CAM production systems for the production of that devices useful for postural correction (such as bust, lumbar belt, etc.). In this context, the sharing of digital design and manufacturing protocols has defined a dynamic of disciplinary interaction that shares the human-centric approach starting from the patient scan (Di Roma, 2019). The biometric data are overlapped to the biomechanical modelling in order to define a numerical model useful for all that kind of

parametrization useful for the richest on person model. At this connection this study has been developed in its experimental phase (desk) thanks to one patient, Federica, that allow the test of the whole process.

Particularly, a spinometry has been performed on Federica. A spiniometry is a non-invasive but reliable postural analysis that analyzes the data obtained by reconstructing three-dimensionally the conformation of the back, the column and the position of the pelvis. Significant was the anatomical study of the muscle extension and the areas involved in the exercise phase, useful to understand what signals the fascia will have to transmit to the App and to monitor the reports. The design process finalizes, also, the possibility of customizing the device both for what concerns orthopedic corrections, and for what concerns the features of comfort and style of device. Customization takes place through an interface managed in contemporary from the medical and patient side. It allows to manage data and interact with the final model of the belt.

From an analytic point of view the research is based on the comparison scientific literature, the research on technology and market positioning of the already in use devices for fitness and wellness. Particularly such studies have been classified using the Kiviat diagram based on a star diagram that takes in account 5 different factors: software, usability, price, aesthetic value, technology.

## 2.2 DESK PHASE

During the desk phase of the study it was possible to identify the devices already in use (already on the market or in the prototype testing phase) that inspire part of the project developed.

In particular, 4 devices are examined: Upright, Icaros, Microsoft Kinect and the Myo from which it has been possible to draw the informal information on the technologies implemented and the general operation.

## 2.3 FIELD PHASE

The main objective is to provide the user with a wearable kit that is able to improve proprioceptive state.

The user will be offered a diagnostic training, monitored by the sensors inside the kit, supported by an App. Being interconnected, they provide the user with continuous feedback on the performance of the physical activity.

## 3. RESULTS

### 3.1 STATE OF THE ART MAIN RESULT

This research, based on the analysis and comparison of the state of the art on ITC technology and intelligent textiles, comes to a first experimental approximation through a wearable kit that provides the user with a postural

experience. The research and analysis of the various case studies taken into consideration, led to the project development to obtain the results listed below:

- study of the different design methods, useful to understand the necessary phases for the development of a good medical product;
- drafting of a wide state of the art, which highlights which technologies, shapes and materials should be implemented to ensure a perfect kit realization;
- study of a graphic interface (App), which is able to provide the user with an alternative to the classic postural gymnastics, to be carried out comfortably at home, but at the same time can provide medical support and feedback;
- identification of the necessary sensors, given by careful research carried out in the field of e-textiles and wearable devices.



Fig. 3. Analyzed devices and kit for wellness and fitness training. They have been classified using the KiviAT diagram on the base of software, usability, price, aesthetic value, technology.

Particularly useful for the desk field research are:  
**RingFit:** has two accessories that detect and measure the movements of players in the real world and turn them into actions in the virtual world. For example, to correct the place it is possible to advance the character, while it includes attacks and attacks are made. In addition, this device monitors the heart rate via a motion sensor

**Levis jacket:** it is smart jacket that connects wirelessly with the phone. On the left sleeve there is a conductive, touch-sensitive fabric. This jacket inside contains a tactile motor, a led, a motion sensor, bluetooth and battery.

**Nadi X:** is a leggings that allows you to practice yoga in a technological way. Inside there are sensors, tactile feedback and a battery. The exercise that the user will carry out through the installed app will guide him through the update, on which parts of the body he must concentrate to carry out this specific exercise.

**Upright Go:** is a device that can be applied directly to the skin, which helps the user to assume a correct posture. To be able to use it, you need to use the app on your device, enter your Bios data in order to better track your posture. Inside there is a LED, a BLE, a USB port and a vibration motor, useful for generating signals in case of incorrect posture.

**Icaros:** a VR device that projects the user into a 3D space. The latter is shown to the user through an augmented reality viewer connected to the Icaros handlebar. Through a single device, the user is able to optimize his therapy rehabilitation phase.

**Cutecircuit:** consists of a sound t-shirt (for deaf users) able to transform the sounds perceived from the outside and send them to the user in the form of vibrations. The presence of 16 micro actuators, present inside it, allows to capture the different sound intensities and to transfer them to the user according to different degrees of sound intensity.

**Myo:** is a bracelet that acquires myoelectric

signals produced by the muscles of the forearm and transform them into commands. Being Hi-tech it allows to control devices of various kinds. It is equipped with 8 EMG electrodes, the IMUs, and the vibration sensors.

**Microsoft Kinect:** it is a sensor capable of detecting 3D images, facial and vocal recognition. It is composed of a camera, a microphone, a motorized pin, a depth sensor, a software capable of detecting movements and gestures.

### 3.2 THE “SMART BELT” EXPERIMENTATION

The experimental prototype is a kit for postural exercise training in the absence of a specialized operator (doctor, physiotherapist, etc.). The kit composed of two devices passively receives the dynamics of the movement and the tensor state and translates it into a series of outputs interpreted in the context of a dedicated App. The reading of these data lends itself to a double interface: patient, physiotherapist/medicine. For both users, suitably processed reading levels are offered that offer the picture of the course of physical rehabilitation and the picture of errors made during the training routine.

This kit, as it is adjustable on the patient's body by means of a Velcro belt, can be readjusted and reused by several people from the same family. The sensor technology applied inside the kit does not require personal calibration, as it is able to detect muscle extension and movements of people with different physicality. The easy adaptability is given by the presence of highly elastic and high-performance materials such as Lycra for the band, which provides additional properties such as breathability, excellent fit and freedom of movement, and silicone for the bracelet, also adaptable and elastic, so that it can also be used as an ankle. The user will be offered a diagnostic training, monitored by the sensors inside the kit, in turn supported by an App. Being interconnected, they provide the user with

continuous feedback on the progress of physical activity.

It is a wearable kit that is able to provide medical support to the user, and which leads to the growth of muscle tone. Starting from scientific bases that interface with medical diagnostics, the kit will be able (unlike the already existing Apps that only partially monitor movement) to detect whether the user is able to reactivate, through movement, that part of the injured muscle that needs strengthening. that improves the physical

condition.

The prototype consists of a device that aims to provide the user with a wearable kit that is able to improve his proprioceptive state through exercise.

This training is continuously monitored by the devices we provide, thanks to the presence of sensors inside it; these send output signals to an App, able to provide an external person (doctor-physiotherapist) with continuous feedback on the performance of postural correction.

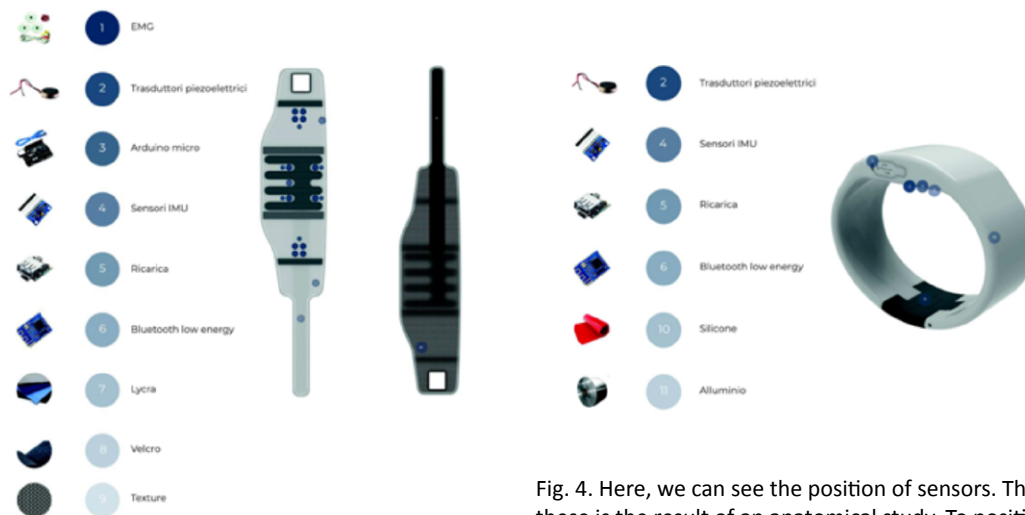
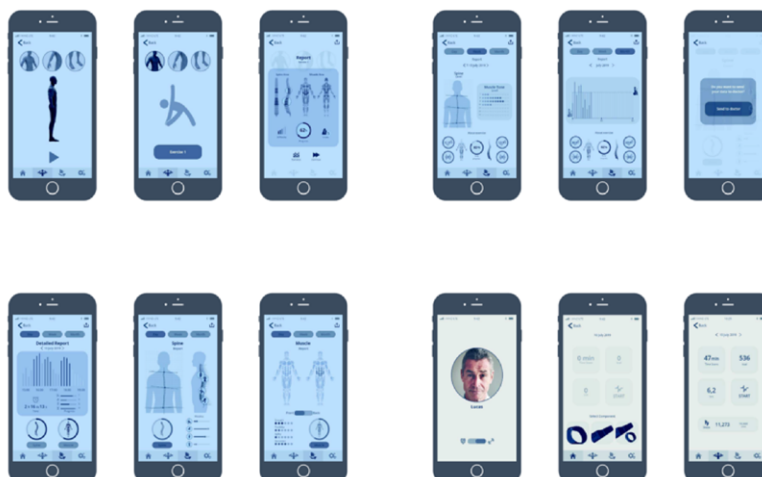


Fig. 4. Here, we can see the position of sensors. The position of these is the result of an anatomical study. To position the sensors in the best way, a muscular analysis was necessary to understand the correct positioning of the EMG sensors.



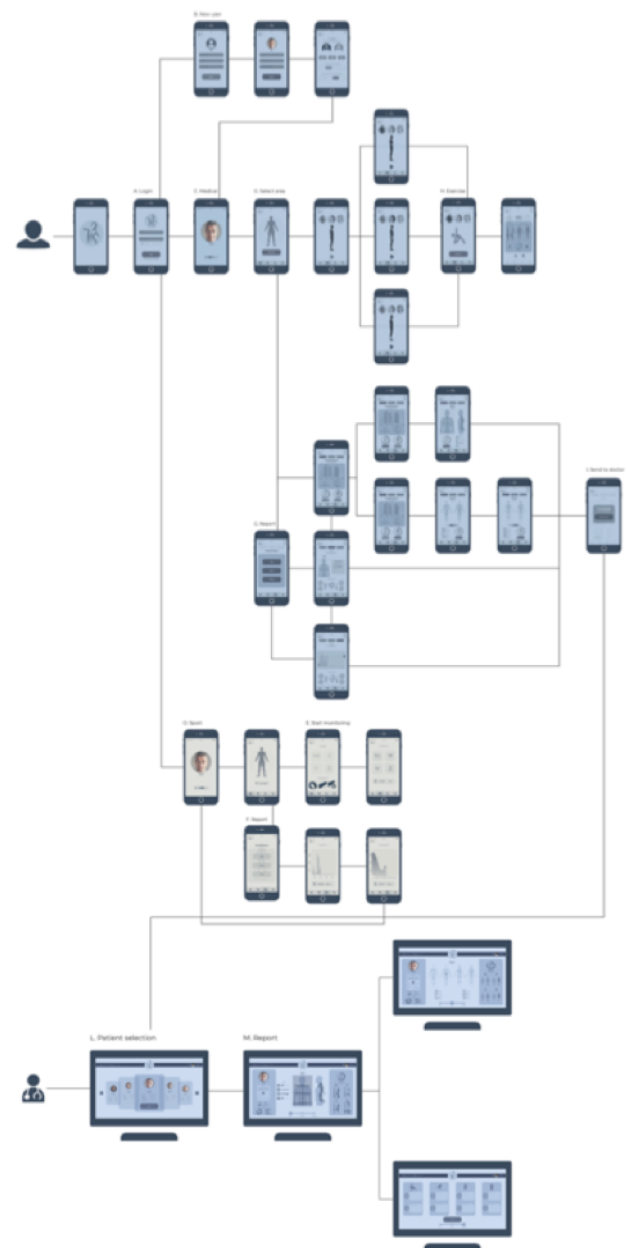


Fig. 5. Here represented the App that has the function to reading the data, monitoring them and also offers the possibility of sending the progress made during training to the physiotherapist. The App leads itself to a double two interface: patient, physiotherapist/doctor, Both users are offered appropriately processed reading levels that provide the state of the rehabilitation progress and gives feedback related with errors and postural detection during exercises. The doctor/physiotherapist, once received the data, could correct the errors directly by the software.





Fig. 6. This image captures the functioning of the prototype. On the right you can see the IMU sensor data movement and the muscle extension monitoring by EMG sensors.

## CONCLUSIONS

The design that interfaces with the scientific medical field, computer science and nanoelectronics represents an important area of reflection that directs design practices to the sharing of protocols and approaches, in order to humanize the experience of rehabilitation in its complex medical dynamics .

The in-depth analysis of the state of the art of IoT devices, wearable devices and sensors currently in use has led to the development and subsequent prototyping of the smart lumbar belt.

In order to carry out the smart lumbar belt, some rx ray and a spinometry was present, a non-invasive but reliable postural analysis that analyzes the data developed reconstructing the shape of the spine, the spine and the position of the pelvis in three dimensions.

The anatomical study of the muscular lengthening

and of the areas involved in the physical exercise execution phase was significant, useful to understand which are the signals that the device must transfer through the App and for the monitoring of the reports.

The proposed device therefore assumes the presence of sensors, which are able to verify and monitor the posture and movements performed during the exercise.

Regarding the already existing Apps, which are more than less able to monitor the movements in part, the designed kit probably will be able to detect if the user is able to reactivate, through constant exercise, that strengthening muscle part and the effect of physical condition. This will be defined after the second experimental phase which includes a number of trial on different patient.



## ACKNOWLEDGMENT

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Capacchione e Maria Carmela Dell'Orco. All the images presented have been realized by them. Federica, also, is the patient number one. I would give them my greetings.

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# CoMFORT ventilation mask project. Lessons learned from the field

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## Abstract

This paper reports and discusses some key methods and findings of the inter-disciplinary design team undertaking a three-year study into improving comfort for paediatric users of Non Invasive Ventilation (NIV) in the NHS. The project proposes a novel use of 3D scanning and printing technologies to offer a bespoke mask provision service.

Five “lessons” are proposed and contextualised with example scenarios from the project.

Key findings have shown the importance of

1. Visual communication methods
2. Involving diverse stakeholder groups
3. Getting hands on with enabling technologies
4. Designing and making test rigs
5. Going around, not stopping at obstacles

We conclude that the visual and tangible methods favoured by 3D designers can help to achieve project aims in interdisciplinary projects. They can improve project outcomes by encouraging engagement with collaborators and stakeholders, as well as building up tacit knowledge of the project context, the enabling technologies and the materials.

This paper also identifies opportunities for areas of related future research.

## Keywords:

**ventilation, mask, 3D, scan, print**

## INTRODUCTION

The project looks at an innovative use of 3D scanning and additive manufacturing technologies to deliver bespoke mask-face interfaces to optimise mask fit to the needs of individual patients. The project also aimed to find out how best to structure a service for mask provision within the NHS.

The project was led by Sheffield Children's NHS Foundation Trust with the collaboration of Sheffield Teaching Hospitals NHS Foundation Trust, National Institute for Health Research (NIHR) Devices for Dignity MedTech Co-Operative and the Art and Design Research Centre at Sheffield Hallam University.

The team from Sheffield Hallam University has an industrial design consultancy background and during this project, observed that taking a "design based" approach has seemingly had a positive impact on project outcomes.

A design based approach can be thought of as having an emphasis on being visual and tactile, on iteratively making and testing, and additionally, being resourceful and adaptable to change.

### CONTEXT

NIV is the delivery of breathing support via a facemask. It is used to treat people whose natural breathing is ineffective. Evidence shows that, when used long-term, it improves both quality of life and life expectancy.

Two particularly disadvantaged groups are very young infants and children with facial deformities or facial asymmetry. In these groups NIV may not be possible due to unavailability of an adequate mask. If the mask interface does not fit the face, it is possible that air leaks from the mask prevent the therapy from being delivered adequately. In this case, a common solution is to overtighten the mask which can lead to discomfort and

facial marking. In extreme cases it can cause skin breakdown, pressure sores and even limit the growth of the face. Alternatively, the patient can be given a tracheostomy and ventilated invasively, but this represents a potential reduction in quality of life for the patient and can put additional strain on the NHS.

## FINDINGS

### LESSON 1: PICTURES ARE WORTH FAR MORE THAN 1000 WORDS

As part of the engagement sessions, the team needed to communicate a series of complex, multifaceted clinical pathways (also called patient journeys) to stakeholders from diverse backgrounds, with the aim of gathering their feedback on the different routes. This included patients, their parents / carers, as well as healthcare professionals such as medical consultants, physiotherapists and nurses. These pathways have an influence on, and are influenced by, a multitude of different stakeholders and external factors. The relationships between them can be intangible and it seemed like it would be difficult to rapidly communicate the dynamics of different scenarios to those unfamiliar with the concepts involved.

### METHOD

The clinical pathways were illustrated in a cartoon-like style, split into scanning and printing scenarios. The patients were shown the scanning scenarios, and the remaining stakeholders saw both scanning and printing scenarios. A slight variation was created, with more technical information overlaid for the benefit of healthcare stakeholders who wanted these details.

## Scenario X

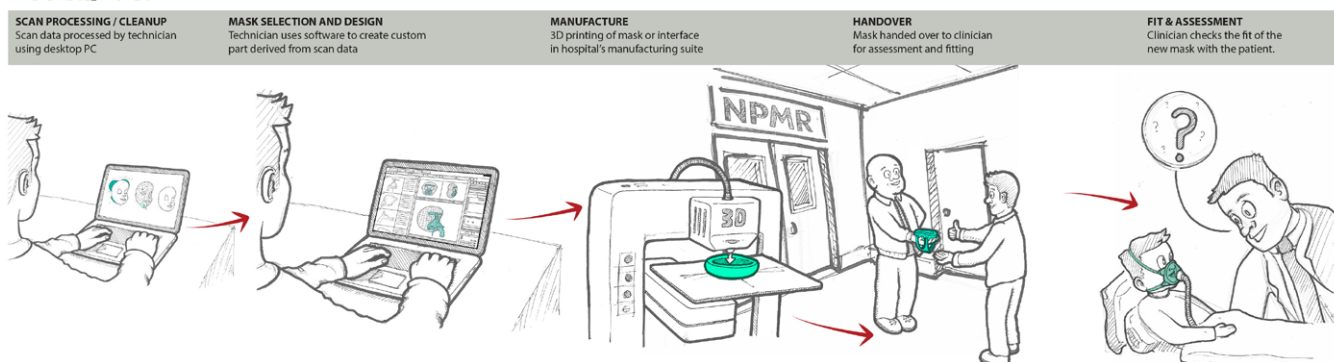


Figure 1: Example of mask design and printing scenario for healthcare stakeholders

objective, as discussion could be directed at the storyboard rather than at an individual.

## FINDINGS

The initial motive for creating the storyboard was as an internal resource for the benefit of the design team, who sought to make sense of the complex and varied demands of the proposed pathways in a way that made sense to them - visually. However, the storyboard went on to become an invaluable resource for successful engagement with stakeholders, in that it allowed for people to easily follow and digest complicated information in a non-technical way. This lowered barriers to understanding and, as it was fun and approachable, it contributed to creating the feeling of a safe space where people had the confidence to contribute their opinion.

Furthermore, it acted as a catalyst for discussion, prompting questions and making people consider things they hadn't thought about before, such as timing or ordering of events, staffing requirements, or the emotion of the patient at any given point.

It facilitated clearer communication between people, particularly if they were from different backgrounds, as they had something tangible they could point at and say "do you mean this? or that over there? And what about this, here?"

It also allowed for people to be more critical and

## LESSON 2: INVOLVE DIVERSE STAKEHOLDER GROUPS

The project sought to engage with a range of stakeholders early in the project to uncover the issues with current mask provision, and later on get useful feedback on proposed concepts from patients, their families, and healthcare professionals.

## METHOD

Repeated engagement sessions at regular intervals throughout the project were undertaken to get feedback from stakeholder groups. Sessions involved the creation of visual communication aids and also used tangible artefacts such as material swatches and current products to stimulate discussion. Clear ground rules were established at the beginning of the sessions, with the aim of creating a safe space encouraging people to share and to value each other's contributions.

The team created structured activities to guide discussion, such as a target with concentric rings of importance, onto which the stakeholders various requirements were placed.

Additionally, a graphic scribe recorded the discussion topics in the form of sketches.



Figure 2: Image of various stakeholders from PPI session, graphic scribe output.

## FINDINGS

Structured activities helped to guide the discussion and provide a format where everyone could contribute to all aspects of the session, especially those who were shy or did not communicate verbally.

It was very useful to involve stakeholders from “patient/parent” and “healthcare professional” backgrounds in the same session. This helped to establish a greater sense of empathy between stakeholders, rather than one group making assumptions about the other, sometimes dubbed “staffroom mentality”. Furthermore, it provided an opportunity for contradictions to arise, in the form of competing needs and requirements for mask provision between different stakeholders. This variety of opinions was sometimes surprising, sometimes conflicting, but always incredibly useful to inform the direction of the project. The graphic scribe recording helped people feel they were being listened to and made the sessions more fun, as well as being a useful resource to refer back to during following sessions.

The visual and tactile materials were very popular with the young patients who loved the soft and flexible materials in particular. This seemed to give them the feeling that these sessions were fun and as a result, more engaging. It also prompted questions and allowed for feedback from them on the suitability of the materials for this application. People respected the ground rules aimed at creating a safe space where all opinions were valued.

Multiple sessions allowed for feedback on concept iterations - giving the team an opportunity to create prototypes based on initial mask needs, and then ask, “is this what you meant?” therefore gaining more insight into what the stakeholders required.

The graphic scribe helped show people that what they were saying was being listened to, as well as serving as a visual reference for further discussions.

## LESSON 3: GET HANDS ON!

At the outset of the project, the team conducted research on suitable materials and additive processes with which to make the masks. Rigid materials are far more commonly used in additive



manufacture than soft or flexible ones. As such, the focus was on determining the means of achieving the soft, cushioning components that are likely to be needed in the final mask design.

#### Method

Initial desk-based research was conducted to create a shortlist for further investigation. Following this, physical samples of 3D printed silicone parts were ordered to see (and feel) what they were really like.

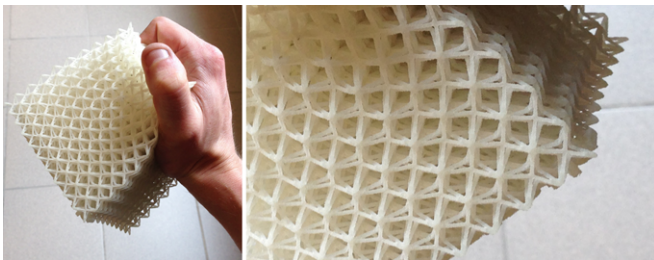


Figure 3: Image showing compliance under load of 3D printed sample.

#### FINDINGS

Being able to see and touch 3D printed silicone samples led us to doubt if the relatively new (at the time) process was going to be suitable for this small, delicate application - the thick layers and low resolution gave a poor surface quality and resulted in stepping on curved surfaces. It was dimensionally inaccurate as it had warped slightly during curing, and the material wasn't quite as soft or stretchy as we would have liked. Obtaining physical samples was key to building the tacit knowledge of the material required to make this important design decision.

#### LESSON 4: MAKE THINGS TO TEST THE THINGS YOU MAKE

The team wanted to test the leak and pressure distribution of early mask prototypes, however an off the shelf solution for testing of prototype paediatric masks did not exist. Therefore, we

chose to design and make a test rig to allow us to objectively test the masks we had designed. The team aimed to create a head phantom that was as realistic as possible in its shape and mechanical properties to ensure data was as relevant as possible.

#### METHOD

Head phantom design was informed by research into tissue depth and Shore hardness value across different regions of the face, and the final shape was derived from a composite of CT scan data from several real-life patients who use NIV to include realistic cranio-facial abnormalities. Tests were conducted into different blends of silicone resin to replicate features such as soft cheeks and harder areas of cartilage.

The head form was created from 3D printed rigid plastic "bone" then covered in several layers of cast silicone "tissue" to replicate different shore harnesses in different areas of the face.

This head form was then mounted onto a rig that allowed for adjustment of headgear strapping tension to predetermined loadings and combined with an array of sensors to measure how this load was distributed onto different areas of the face for different mask designs.

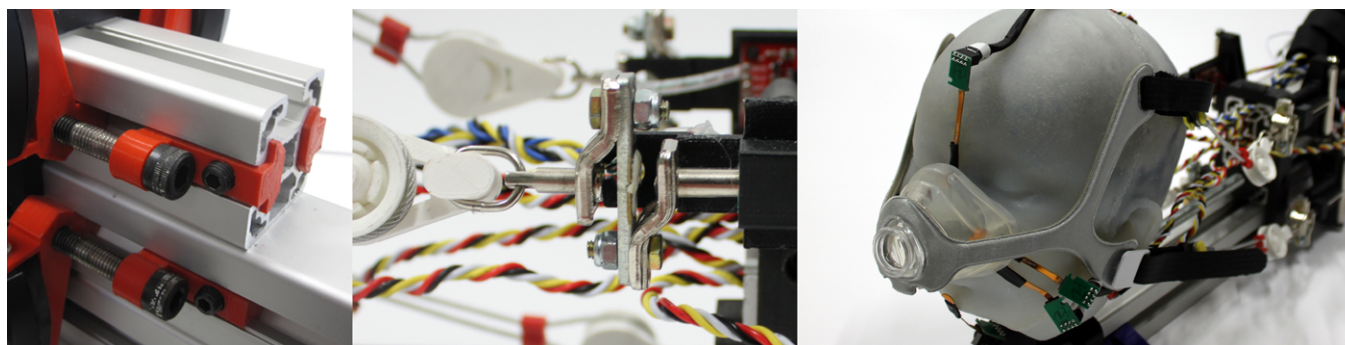


Figure 4: Images of testing rig. L-R - adjuster screws, load cell, head form with mask.

## FINDINGS

Creating the custom test rig allowed the team to generate quantitative data to objectively compare current masks and new mask concepts. This informed which designs to take forward to later design stages.

Furthermore, designing and creating the head phantom helped the team build up their understanding of the physical structure of the face and potential facial abnormalities of mask users. This background knowledge helped inform the design of the mask by giving the non-medical design team more awareness of the physical structure of the face.

Building project specific rigs not only achieves the aims of providing test data, but inevitably also builds up additional knowledge around the core area of research.

## LESSON 5: DON'T STOP AT OBSTACLES, GO AROUND THEM.

Owing to the limitations of silicone additive manufacture mentioned previously, the team needed to find a way of manufacturing a suitable cushioning component without 3D printing. The team had already carried out testing to verify that a degree of cushioning would be required for user comfort and to minimise air leakage - a fully

rigid mask wouldn't provide this. Ideally, to best achieve the original project aims, this component would be 3D printed in silicone to allow it to be bespoke for each user without tooling investment. However, the 3DP silicone process was not at the quality required for user trials, and the regulatory conformity was not in place. Another way to create a part with the necessary physical properties was required.

## METHOD

A variety of non-additive, alternative manufacturing concepts were proposed and discussed with potential suppliers. The clinical engineering team at Sheffield Teaching Hospitals provided expertise on medical device regulatory compliance. Physical prototypes were created to explore and communicate the various advantages and disadvantages of each process.





Figure 5: Sketch images of proposed post-print finishing techniques

## FINDINGS

After exploring various manufacturing options and discussing them with suppliers, the team decided on a hybrid approach to the mask production. The flexible component of the mask was formed by casting medical- grade silicone into a mould. This formed silicone component would be stretched over and deformed by a bespoke shaped, 3D printed, rigid frame to create the final bespoke mask. Each component was manufactured in a quality assured clean room by contracted companies operating a medical device quality management system (ISO 13485:2016). This combination provided the mechanical properties and regulatory compliance needed from the silicone part, and the bespoke, 3D printed part provided structure and a closely conforming fit to each individual patient's face.

We found that although this hybrid approach was a compromise on the original project aims, it allowed the remaining project aims to be met. We kept in mind that the 3D printing technology will improve in the future and although it uses different techniques, this project outcome can still successfully form the basis of a pathway for effective delivery of custom masks for ventilation therapy.

## CONCLUSION

We conclude that the visual and tangible methods favoured by 3D designers in general, combined with the patient public involvement required for clinical research, can help to achieve project aims in inter-disciplinary medical device projects. Their use can improve project outcomes by encouraging engagement with collaborators and stakeholders and foster a building up of tacit knowledge around the project context as well as the associated enabling technologies and materials.

The resourcefulness of a designer is helpful in achieving project aims, even if outcomes are different than the scenario proposed at the project outset. This is particularly relevant where projects aim to make use of still emerging technologies, and where project timescales and the rate of technological progress are similar. No individual piece of learning or observation has proved to have higher importance than another; it has been a combination of them together that has provided the most significant positive impact to the project.

## **OPPORTUNITIES FOR FUTURE RESEARCH**

The project has identified opportunities for future research projects in the areas of:

- 3D printing of biocompatible, regulatory-compliant silicone for face mask cushioning
- Development of a medical device regulatory-compliant quality assurance process for 3D printed silicone
- 3D design software or tools that could enable mask design by healthcare professionals
- Development of new types of mask headgear
- Application of this local research to international healthcare settings

## **ACKNOWLEDGEMENTS**

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# Diagnostic Model to Improve Workers Productivity

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## Abstract

Companies operating in the design and advertising (D&A) market, frequently use vector and raster drawing tools requiring some specialization of their use. Such type of tools might impact the performance of people with physical or psychological impairments. Therefore, from a social inclusion perspective, the paper aims to mitigate the impact of such constraints. The paper presents a diagnostic model conceptualized based on guidelines derived from the inclusive design research area. It also provides a set of recommendations addressing the improvement of the employee comfort, in particular of those with symptoms that may be degenerative, chronic, temporary, or acquired at the workplace. An exploratory approach, following the action research methodology, was applied. The main goal was to understand the level of sensitiveness to social inclusion detained by employees, employers and product suppliers. A set of valuable suggestions were collected through interviews, in particular, about the type of service to be considered to approach the end-user concerns. The paper also addresses the DataOps methodology emphasizing aspects related to communication, collaboration, integration, automation and measurement of cooperation. The diagnostic makes use of algorithms, which consider demographic data and keywords to infer the degree of severity of the psychosocial and psychomotor constraint of the person. The outcome is a list of Standard Operating Procedure (SOP) determined based on the user profile (i.e., reported metadata) and on additional parameters. The diagnostic addresses seven dimensions of analysis: hardware, software, ergonomics, thermal, noise, structure and illumination, including information on possible fiscal benefits.

## Keywords:

**DataOps, Inclusive Design, Situational-awareness, Employee Well-being, Predictive Modelling.**

## 1. INTRODUCTION

From a branding point of view, one of the core features of the D&A market is to endorse the user experience, promoting the engagement and active participation of the consumer in the life of a brand simultaneously. As such, D&A professionals often need to work with a vector and raster design tools to create appealing advertising pieces (Fernandes, L., 2015). However, working with such tools requires some abilities; the use of such design tools might become a significant constraint for people with psychosocial and psychomotor problems (Ceballos, P. V., et al., 2015). The proposed diagnostic model, created based on a market analysis carried out by several entities (D&A companies, assistive product suppliers, associations, prescribers and the end-user), addresses new ways of interacting with such tools, identifying procedures to streamline their use by most of the D&A professionals, on a regular/daily basis (sporting a social inclusion concern). In this field, the research work tried to provide a solution (Diagnostic Model) to help people with disabilities to become more proficient using resources that may help them in becoming proficient in a very competitive market. The conceptualized solution took inputs collected from interviews to market stakeholders, which considered the approach innovative in trying to make use of existing assistive products to empower people, with severe constraints, willing to work in the market. The identified assistive products were classified according to their characteristics in mitigating the impact of each reported symptomatology and also based on the degree of severity that they would be able to compensate in order to overcome the person cognitive or physical constraints. Employers foresaw the proposed solution as an opportunity to promote social responsibility within the company, namely in addressing aspects related to the wellbeing of the current workforce (Eon, F., 2015).

## 2. PROBLEM IDENTIFICATION

In a professional context, the person may require adjustments concerning the tasks they perform or the materials they use, due to some eventuality, in which a temporary or permanent (chronic) pathology/symptoms may have arisen. When mobility is affected by the pathology, professional's physical capacity may be severely affected (Bessa, T. C., 2012). People with temporary or permanent psychomotor or psychosocial disabilities have to face intense adversities to get the first job or perform their jobs with the expected performance quality. To address these concerns, we have formulated the following research challenges:

- How to approach new forms of interaction with vector and raster drawing tools for people with psychosocial and psychomotor problems;
- Identify procedures to expedite the inclusion of people with psychosocial and psychomotor problems in the professional sector;
- Conceptualise an informational structure for the elaboration of diagnosis, with a layout simple to be used by all stakeholders.

From the market analysis, it was possible to conclude that 52.9% of the interviewed entities considered the topic relevant and useful from a social inclusion perspective. Section 5 presents a summary of the surveys and interviews performed to target entities (e.g., associations, prescribers, D&A companies and assistive product suppliers), and the end-user (i.e., customer-segment). A summary of the business vision was built using the Lean Canvas (Pereira, D., 2017), a tool created by Ash Maurya based on Business Model Canvas, but replacing 4 of the 9 original blocks adapting the model to projects with a technological background and aiming to create a startup. The Lean Canvas is more focused on being a one page

summary with an actionable and entrepreneur-focused business plan proposal. Lean Canvas, It also helps in justifying the Unique Value Proposition (UVP) - the translation of product or service features into customer benefits - in a clear and concise way. Table 1 presents the Lean Canvas as an informational artefact presenting the solution and the actions to be taken/implemented in the workplace context based on the needs of the target audience. The proposed solution helps to define communities to share information and

manage knowledge about user specificities; with a proposal to integrate tax benefits as an additional incentive to the adoption of social and inclusion policies by the employers. An approach particularly adjusted for employers willing to invest in assistive products to improve the working conditions of their employers, assistive product suppliers interested in creating competitive advantages through differentiation (specialized offer) of their products simultaneously.

Table 1. Lean Canvas for an inclusive and sustainable approach to the proposed solution.

<h3>Problem</h3> <p>Challenge 1: How to approach new forms of interaction with vector and raster drawing tools for people with psychosocial and psychomotor problems;</p> <p>Challenge 2: Identify procedures to expedite the inclusion of people with psychosocial and psychomotor problems in the professional sector;</p> <p>Challenge 3: Conceptualise an informational structure for the elaboration of diagnosis, with a layout simple to be used by all stakeholders.</p>	<h3>Solution</h3> <p>A diagnostic model to help people with psychomotor or psychosocial disabilities integrate into the professional market or to help employees perform their job better.</p> <p>In this domain, the model proposal identifies informational artefacts that enhance a knowledge base and behaviors to adopt / operate in the workplace.</p>	<h3>Unique Value Proposition</h3> <p>Provide an informational diagnosis of the actions that should be taken / implemented against the context and needs of the target audience in the workplace;</p> <p>Provide recommendations and guidance to employers on which <b>Assistive</b> products to adopt in the context of the employee's context and needs;</p> <p>Triggering opportunities to develop innovative technology solutions in a niche market;</p> <p>Allow monitoring progress against the evolution of psychosocial and psychomotor problems diagnosed in the target audience or mitigate the diagnosed risk;</p> <p>Creates communities to share information and knowledge management about user specificities;</p> <p>Integrated tax benefits in the face of social concerns and inclusion of the entity.</p>	<h3>Unfair Advantage</h3> <p>The proposed model addresses the interests of five actors (the individual, the employer, the providers of assistive products, the associations and the prescribers / evaluators);</p> <p>Knowledge about the benefits of offering existing <b>Assistive</b> products, the needs of the target audience, having a procedure to address the pathology / symptomatology constraints to improve task performance.</p>	<h3>Customer Segments</h3> <p>People with psychosocial and psychomotor problems with chronic, degenerative, temporary, acquired and mental problems;</p> <p>Employers in the D&amp;P sector willing to invest in assistive products to improve the working conditions of their employees and / or to recruit people with psychomotor and psychosocial disabilities;</p> <p><b>Assistive</b> product suppliers interested in creating competitive advantages through differentiation (specialized offer) and sale of their products;</p> <p>Associations where the target audience is interested in helping people with specific needs more easily, directly and concretely;</p> <p>Prescribers and evaluators willing to provide their services in improving the workplace conditions of employees.</p>
<h3>Key Metrics</h3> <ul style="list-style-type: none"><li>o Number of <b>Assistive</b> products tailored to specific needs and list of identified SOPs;</li><li>o POP Compliance and Clogging Rate;</li><li>o Total referenced pathologies and symptoms;</li><li>o Total symptoms and tasks recorded.</li></ul>	<h3>Cost Structure</h3> <ul style="list-style-type: none"><li>o System development cost under SaaS model, including corrective maintenance costs and evolutionary maintenance costs;<ul style="list-style-type: none"><li>- Study of learning algorithms in the area of data analysis (Predictive Modeling) as well as in the area of Artificial Intelligence.</li></ul></li><li>o Collaboration of health professionals in the survey and characterization of SOPs;</li><li>o Hosting the solution on a cloud server.</li></ul>	<h3>Revenue Sources</h3> <ul style="list-style-type: none"><li>o Licensing of services provided (Software-As-A-Service SaaS);</li><li>o Financing via investors with visibility and recognition at the level of social inclusion;</li><li>o Rate resulting from the contribution of the model in the sale of <b>Assistive</b> products (Partner - Product Suppliers);</li><li>o Incentives arising from the promotion and adoption of good practice including improvement of workplace conditions (Partner - Employers).</li></ul>	<h3>Channels</h3> <p>Internet: multichannel information dissemination (web interface and mobile devices), facilitating access to information through the QR Code;</p> <p>Associations / prescribers / evaluators: dissemination of the model through these entities;</p> <p>Diagnosis: mechanism for formalizing the need to use <b>Assistive</b> products (diagnostic card and online tool).</p>	

### 3. PROJECT SCOPE CHARACTERIZATION

#### 3.1 DESIGN AND ADVERTISING SECTOR

In 2018, In the D&A market, there was an increase of 5.6% in advertising revenues, and in 2019 it will grow 3.4% to reach 620 million Euros, representing about 1.3% of D&A and 1.1% of total employment (52.00 jobs). The digital sector represents 29% of the total advertising value (Durões, P., 2019). According to (Marques, R., O., 2018), statistical data shows that in 2019 the D&A market sector evolved compared to 2009. In 2019 D&A companies' turnover was 620,000,000, increasing 156.8% since 2009, the number of jobs has also increased by 32.7%.

The creativity plays a significant role, requiring some conditions and inspiration which may take time. Therefore, workplace comfort can become a crucial aspect in helping professionals to be happier while being creative, improving their capabilities simultaneously when working with raster and vector tools (RPC Afiliada Globo, 2015). In this domain, a designer may have to perform tasks related to computer graphics; interaction design; animation design; industrial design; digital design; graphic design and product design (Redação, 2012). A D&A professional often uses conventional hardware devices with vector and raster design software (CITI, 2018); however, conventional devices do not comply with the requirements workers with permanent or temporary impairments usually have. Given the lack of adequacy of conventional tools and, in particular, the problems addressed in the use of raster and vector tools, we have approached the market and asked D&A companies, assistive product suppliers, associations, prescribers and the end-user to validate the proposed solution. The outcome was the diagnostic model presented in Figure 2 (see Section 4), aiming to help people with disabilities to integrate into the D&A market.

#### 3.2 INCLUSIVE DESIGN

Table 2. Contacted entities.

Entity Type	Total Surveys Sent	Total Answers	Total Interviews
1st Phase Audience	---	8	0
1st Phase Associations	18	0	10
2nd Phase (total)	105	34	13
Target Audience	30	22	0
D&P Companies / Associations	57	11	10
Providers / Prescribers	18	1	3

In a very narrow scope, inclusive design is sometimes confused with the development of specific solutions for people with disabilities (Cristian, L., 2013). However, when conceptualizing a solution with the active participation of those who will use that solution (e.g., people with disabilities) is just a way of ensuring suitability for a broader range of potential users. During the design of the diagnostic model (Figure 1 and 2,) several entities were characterized during the market analysis as presented in Table 2. Thus, the recipients of the most inclusive solutions are all citizens, not just those with difficulty in interacting with the standard solutions (Simões, J., F., & Bispo, R., 2006). Some studies (Economias, 2019), report that one of the aspects of corporate social responsibility is internal policies, in particular when there is a corporate conscious in balancing between the management of technical and soft expertise, in addition, to provide a healthy environment for workers to feel comfortable, engaged and committed to becoming strategic resources. Internal social responsibility may consider aspects such as occupational health and safety policies; equal opportunities in recruitment; continuous formation; the balance between personal and professional life; career path, progression and job stability.



Another dimension of corporate social responsibility relates to the relationship with customers, suppliers, investors and the community. Corporate social responsibility actions may include Local Community: Employment opportunities; Provision of company resources for social initiatives; Support in the construction of infrastructures; Transmission of know-how. Furthermore, provide a customer perspective: Consumer health and safety; Customer privacy; Quality products and fair price. The proposed diagnostic model promotes employee wellbeing by providing recommendations to a range of devices tailored to professionals. The model analyses the situation based on seven-dimensional levels addressing a solution adjusted to the specific needs of the worker. The diagnostic model promotes equal opportunities in recruitment because, with the proposed solution, everyone will have the possibility to perform their job function with the expected performance. It provides resources for social initiatives, supports the construction and improvement of infrastructures enabling the employer to be aware of how to adapt the existing infrastructure to cope with workers permanent or temporary constraints. Such know-how can be easily

managed by the entities, as the algorithms do all the maintenance and reconnaissance work, such as providing the necessary contacts to users, as well as the assistive products and standard operating procedures. Finally, the diagnostic model provides user privacy.

### 3.3 TARGET AUDIENCE CHARACTERIZATION

Through the market analysis carried out, it was concluded that the target audience is people who have degenerative, chronic, temporary, acquired or mental pathology, with a moderate (5% -24%) severity (25% -49%), and severe (50% -95%), where they have physical problems in terms of motor coordination and precision of movement, namely people with musculoskeletal disorders, fine motor skills and people with psychosocial problems. We also considered Psychosocial diseases because it may impact workers productivity (e.g., level of concentration, creativity) and stress level. Due to these problems, the tendency is to impact the capability of workers to elaborate activities that require a precision of movement, favouring the appearance of problems such as muscle tremors and others.

Table 3. Pathologies and symptomatology related to the target audience.

	Psychomotor Pathologies	%   Nº Portugal		Symptoms	Correspondence
Degenerative Pathologies	Arthritis / Osteoarthritis	40 Mil		Affects Movement	
	Muscular Dystrophies	150		Reduced Dexterity	
	Neuromuscular Diseases	100 Mil		Muscle Tension / Stiffness	
	Sclerosis	8 Mil		Muscle weakness	
	Huntington	150 Mil		Spasms / Uncontrollable Movements	
	Parkinson	20 Mil		Feeling of Imbalance / Lack of Motor Perception	
Chronic Pathologies	Motor Dyspraxia	150		Tremors	
	Fibromyalgia	300 Mil		Joint pains / Muscles	
	Myasthenia	300		Muscle Atrophy	
	Myositis	14,9%		Muscle Numbness	
	Neuropathies	8%		Progressive Degeneration of Muscles	
	Cerebral Palsy	20 Mil		Inflammation / Swelling	
	Essential Tremor	5%		Limb Paralysis	



Table 3 shows the predominant and common factors of the limitations of the pathologies causing functional movement disabilities, the stiffness of the muscles and lower dexterity of the limbs. The coloured circles present the correspondence between the pathology and the symptomatology. The first symptomatology refers to the one that has a higher prevalence (i.e., all pathologies gather that symptom). The main focus was on the physical issue that hinders synchronous handling and interaction using conventional hardware devices and the mental strain generated by the pace of work, where existing solutions on the market do not yet allow proper interaction with vector and raster design programs. We considered some psychosocial factors as the interaction between work, professionals, environment, job satisfaction and organizational conditions. These factors influence the health, well-being and performance of the professional (Ceballos, P. V., et al., 2015). According to (Rabaça, C. & Gomes, P., 2017; Noronha, N., 2017; Genésio, F., 2017; Ferro, C., 2018; Sanches, A., 2016; Oliveira, S. D., 2003; Lusa, 2004), in Portugal: 5% of people have essential tremor; 87% have burnout symptoms; 39% have spinal cord injury; over 40,000 people have arthritis; approximately 150 have muscular dystrophy, with a high prevalence of neuromuscular diseases; around 5.9 million have musculoskeletal rheumatic diseases; 8 thousand have multiple sclerosis; 300 thousand have fibromyalgia; 1 million have osteoarthritis problems; 20 thousand have cerebral palsy; 16.5% suffer from generalized anxiety, 400 thousand have depression, 500 thousand have the panic syndrome, and 650 thousand have posttraumatic stress. According to (Census, 2011), in Portugal, 38,3% have problems that limit professional activities, 34,8% have problems related to joint muscles and bones. Another study (Oliveira, C. D., 2016) says there are 91.30% software resources and 69.57% computer support in the market.

These are pieces of evidence about the relevance in providing a solution to specify a diagnosis (Figure 1 and 2) that allows these professionals to perform work in high complexity vector and raster design even when confronted with the mentioned pathologies.

### 3.4 ASSISTIVE PRODUCTS

Assistive product is a term used to identify resources and services that contribute to improving the functional abilities of people with motor disabilities and thereby independently promoting their quality of life and their inclusion in the society and the workplace (Sartoretto, M. & Bersch, R., 2018). Currently, there are several assistive products on the market, such as manipulators, from which the user does not need to use his hands or arms to operate the computer. Such products are useful for people who have difficulties/pathologies like Parkinson, could use the eye-tracking functionality to perform vector and raster work on the computer. Pointing devices (e.g. computer mouse) and keyboards are also useful devices because they can be adjusted to people with arthritis/tendonitis pathology. Another assistive product component are trigger supports, (e.g. pressure trigger, voice trigger) and software used to complement the use of physical devices. Some categories of assistive products are not related to hardware and software, but rather to workplace space/layout, such as ergonomic, thermal, lighting, noise and space structure products. All of these types of products can also condition the welfare outcomes of these individuals with psychomotor and psychosocial problems.

During the market analysis (Section 5), we have contacted suppliers requesting them to share their opinion about how well informed people were about the benefits and the existence of assistive products. Understand from their knowledge the adequacy of existing assistive

products in addressing most of the problems derived from long working hours with digital tools. The goal was to identify the essential aspects (i.e., metadata that need to be collected) to support the algorithmics of the diagnostic model and the corresponding prescription given to the user.

### 3.5 RESOURCES USED IN THE SOLUTION PROPOSAL PROCESS

The specification diagnostic model (Figure 1 and 2) followed the software-as-a-service (SaaS) paradigm. This approach facilitates the provision of data information about assistive products and workplace recommendations targeting the specific needs of the analyzed users. The SaaS paradigm is one of the three main categories of cloud computing (Rouse, M., 2019); therefore, the proposed solution has a web-based layout and is compliant with a microservice architectural approach.

The specification of the system info-structure followed the DataOps (data operations) methodology, which is a data method that emphasizes the communication, collaboration, integration, automation and measurement of cooperation (Calaça, L., F., 2018). The DataOps concept derives from the Software Development and Software Operation (DevOps). DataOps is an emerging discipline that brings together DevOps teams with data engineer and data scientist roles to provide the tools, processes, and organizational structures to support a data-focused approach. In this paper, information corresponds to data complemented with the spatio-temporal context valid when the data were collected/reported. The main goal is to continuous delivery of analytic insights with the primary goal of satisfying the customer, improving their ability to work with data and to respond to real-world events as they happen.

DevOps can be summarised as a set of practices that works to automate and integrate the

processes between software development and IT teams, so they can build, test, and release software faster and more reliably (Lopes, A., 2019). There are some algorithms contained in the diagnostic model system, such as search algorithm, pattern recognition, keyword extraction and grouping. The model uses algorithms that, according to pre-disposed keywords, provide user procedures with recommendations and assistive products, and the model also uses the learning system machine.

## 4. DIAGNOSTIC MODEL PROPOSAL

The diagnostic model serves to help people with disabilities, identifies a set of informational artefacts, enhancing the knowledge base on what behaviours to be adopted, and changes to be implemented, in order to maintain productivity and workability levels. The goal is to mitigate the risk of the employee being affected by derogatory emotional states derived from psychomotor or psychosocial problems. The model, based on the reported impairments (or predominant symptom), provides a list of Standard Operating Procedures (SOP) which may compensate some of the constraints or at least mitigate their impact in the worker proficiency. The proposed solution presents a printed and online diagnostic card.

**RSI (Repetitive Strain Injury)**  
 RSI is caused by mechanisms of aggression, ranging from repeated efforts continuously or that require a lot of force in its execution, even vibration, posture inadequate and stress. There are professionals exposed to greater risk; people who they work with computers, on assembly and production lines, musicians, etc.

**Rate**  
 A = Slight | 5-24%  
 B = Moderate | 25-49%  
 C = Severe | 50-95%

**Predominant Symptoms**  
 Pain in the upper limbs and fingers;  
 Antrill;  
 Muscle fatigue;  
 Reduced range of motion;  
 Alteration of Temperature and Sensitivity.

**Aggravating**  
 Inflammation;  
 Physical and Mental Exhaustion.

**Strategies to adopt**  
 Provide safety and long breaks in the workplace;  
 Rest of compromised musculoskeletal structures;  
 Physiotherapy;  
 Post-employment activities / events (e.g., investment other interests with greater coexistence among employees such as tours, sports activities, contests).

**Workplace**

Type	Name	Adaptation	% Clogging	Cost Estimated
Thermal	Heater	Quickly	49%	19 €
Lighting	LED Lights	Quickly	13%	80 €

**Assistive Products**

Type	Name	Adaptation	% Clogging	Cost Estimated
Ergonomic	Chair Ergonomic	2 Month	5%	359 €
Ergonomic	Orthoses Dynamics	Temporary	17%	16 €
Hardware	Alternative Mouse	1 Month	75%	294 €

System Reference: \_\_\_\_\_ Date: \_\_\_\_\_

Fig. 1. Printed diagnostic card.

The printed card presented in Figure 1, should be used for a preliminary characterization analysis of the type of diagnosis, providing the healthcare professional (e.g., occupational medicine) generic guidelines based on the person's profile. In characterizing the final diagnosis, the healthcare professional will have to fill in the "system reference" and the date to improve the outcome diagnosis. As shown in Figure 1, the printed card is structured into five sections. The first section refers to the pathology where the problem is identified, providing a description and outlining the total number of people with the same type of problem. The second section includes information about the degree of severity, which may be considered mild, moderate, or severe. The third section outlines the degree of severity for the reported pathology with the main prevention mechanisms. Section four presents generic recommendations addressing the improvement of the workplace conditions, and in section five, the QR Code streamlines access to the online model, for a deeper analysis. The online model provides a self-service approach, enabling the user to be assisted by the system when reporting the data. The main objective is to provide users (who can contact the employer,

using the reference code provided by the system) with a tool to anonymously analyse what kind of assistive products exist to mitigate their suffering, providing a cost/benefit analysis simultaneously. Figure 2 shows the homepage structured into four sections. The first section enables the user to select from a predefined list which pathologies or what predominant symptom they have. Each selected pathology provides a description and the estimated percentage of people in Portugal with the same type of problem/condition. The second section allows the input of demographic data, which will be used as input parameters for the diagnostic algorithm; these attributes are required to refining the match of the final result. In the third section, the user can enter multiple keywords about symptoms and tasks they have to perform. In this section, the user should select from a predefined list which ones best characterize their psychomotor or psychosocial condition. If none is appropriate, the user can add a new concept (i.e., free text) to the list in the "Keywords Symptoms" and "Keywords Tasks" section. Once completed, the user executes the algorithm (i.e., by clicking on the "Determine POP" button) for the system to determine which standard operating procedures best match the search parameters entered.

The figure displays two screenshots of a web application. The left screenshot is the homepage, and the right screenshot is the prescription page.

**Homepage (Left):**

- Pathology:** A dropdown menu for selecting a pathology. Below it, a table shows the selected pathology and its description.
 

Pathology / Predominant Symptom	Description	% D&A
RSI (Repetitive Strain Injury)	Repetitive Strain Injury is a disease ...	3173
- Demographic data:** Fields for Birth date (22/06/1980), Gender (Male), Qualifications (Graduation), Locality (Lisbon), Activity Sector (Design & Advertising), and Occupation (Graphic Designer).
- Keywords Symptoms:** A list of symptoms including Pain in the Limbs, Inflammation, Stress, Finger Pains, and Headaches.
- Keywords Tasks:** A list of tasks including Catch the Mouse, Move the Mouse, and Monitor Focus and Concentration.
- List of Standard Operating Procedures:** A table showing the results of the algorithm.
 

% Conformity	POP	% Clogging	Cost Estimated
7%	Posture and rest are important to prevent injuries	25%	494 €
70%	READ and DORT - Guide on focusing on the computer	49%	1,673 €
88%	Repetitive Strain Injuries on the Computer - How to Avoid?	100%	1,181 €
16%	Visual computer syndrome - Link Online	26%	85 €

**Prescription Page (Right):**

- Code Ref.:** A field for entering a reference code.
- Pop:** A dropdown menu for selecting a pathology. Below it, a table shows the selected pathology and its description.
 

Pop	Description	% D&A
Repetitive Strain Injuries on the Computer - How to Avoid?	100% clogging and cost estimated €	8,13
- Workplace Recommendations:** A table showing recommendations for various types of equipment.
 

Type	Description	ISO Ref.	Adaptation	Benefits	Clogging	Costs	Requirements
Thermal	Heater	REF. 6520	Quickly	0%	10%	19 €	A
Noise	Hearing Protection	REF. 0683	Quickly	0%	5%	178 €	A
Structure	Tempered Glass	REF. 5983v	Quickly	5%	10%	119 €	A
Lighting	Led Lights	REF. 4949i	Quickly	5%	10%	80 €	A
- Assistive Products:** A table showing recommendations for various types of equipment.
 

Type	Description	ISO Ref.	Adaptation	Benefits	Clogging	Costs	Requirements
Ergonomic	Ergonomic Chair	ISO. 6520	2 Month	10%	5%	359 €	P
Ergonomic	Dynamic Orthoses	ISO. 0683	Temporary	5%	15%	16 €	P
Hardware	Arm Support	REF. 4568	3 Weeks	15%	10%	12 €	P
Hardware	Support Forearm Support	REF. 6976	2 Month	15%	20%	104 €	P
Hardware	Alternative Mouse	ISO. 9496	1 Month	10%	15%	294 €	P
- Additional Information:** Links to SAPA Regulation, Assistive Products Assignment System, Multipurpose Medical Certificate of Disability, and Practical Guide - Social Benefits for Inclusion.

Fig. 2. Online interfaces, left - homepage, right - prescription page.

Figure 2 (left) also presents a list of the SOPs that the algorithm can identify, this list identifies, in the first column, the SOP compliance rate lists against the search criteria, the last two columns indicate the clogging rate and the expected cost for implementing the SOP recommendations. The clogging rate is a prediction of the impact on mitigating the reported problem; the implementation of the recommendations of this SOP can address the disabling factors up to the indicated percentage value. They are thus contributing to a predictable increase in employee comfort and productivity. The user must select which SOP to analyze (“View Results” button) to activate the recommendation view. The diagnostic algorithm is based on the set of parameters entered (i.e., pathologies, demographics and keyword list), this metadata then allows the listing to be sorted by compliance criteria, alphabetically by SOP name, clogging or implementation cost. The metadata set also allows us to infer the degree of disability, an essential parameter for the type of recommendations to be presented in the interface of Figure 2 (right), prescription page. The prescription page presents the layout with the information about the result of the execution of the diagnostic algorithm.

This diagnosis uses the metadata reported on the homepage (Figure 2, left) and depending on the chosen SOP; it presents the most appropriate solution. The presented information includes data on the percentage of people with the same pathology, along with information on the most appropriate types of assistive products. Each type of assistive product is listed with an estimation of the adaptation time and a proposal for tax benefits. The idea is to provide additional incentives for employers to invest in such technology, increasing in this way, the comfort and conditions of the workplace to their employees. With the reference code, the user can access the results of the prescription page, in another situation, print or send that

information by email. In the Recommendations section, the Clogging column provides information on the expected benefit/gain by adopting the recommendation.

The Cost column provides an estimate of the investment effort. Finally, the Requirements column indicate whether the solution needs a medical prescription or an evaluation (e.g., P = Prescription, A = Evaluation) by an accredited entity. At the Assistive Products section, the user will be able to select all, or only a few of the suggested products that they consider having a most immediate impact, increasing comfort and productivity in job performance and workplace conditions. In this area, there is a need to raise awareness of incentives that enable companies to adopt integration policies and improve the quality of life of their employees. This section is particularly relevant for the employer to be aware of possible improvements.

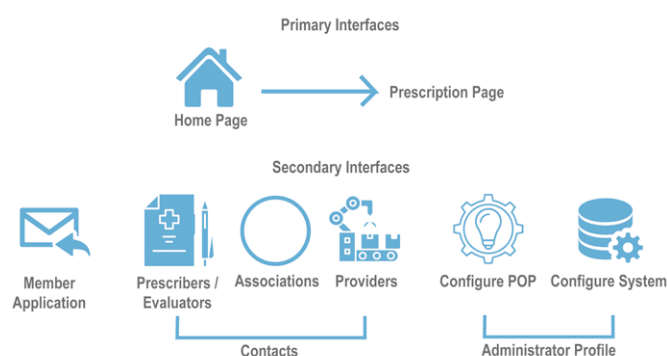


Fig. 3. The architecture of the diagnostic model interfaces.

Figure 3 shows a scheme with other diagnostic model interfaces, such as the application for new members, where entities such as suppliers or prescribers can apply, and advertise their products. The contact interface of assistive product suppliers, associations and prescribers, to make it easier for users to find the desired entity. The interface of system configuration, available only for the administrator profile, it is possible to configure the data structure required by the online diagnostic model. The pathology

lists with their similar symptoms are configured. It also has a section to view and manage the list of new SOPs (suggested by users), only those that are validated and accepted by the administrator are activated and presented in the list of SOPs that the diagnostic algorithm will consider. And the configuration of a new SOP interface corresponds to the configuration of a new procedure. The system administrator specializing in the health field, must complete all fields on this interface. This interface has three blocks, in the first block the name of the procedure and its description will be filled, as well as the keywords corresponding to the pathology, the degree of severity, the symptoms, the tasks, the sector of activity and their respective functions. This metadata will be used by the diagnostic algorithm to match the keywords (reported by users) entered on the system's homepage. The second block is to report metadata regarding recommendations to the workplace and list the assistive products that will correspond to the solution prescribed in the diagnostic model. It is also in this section where the information about the total cost and clogging column are reported. In the third block, the administrator can upload additional files to complement the information associated with the SOP. Once all fields have been completed, the effective date will be posted, and the SOP may be published.

## 5. VALIDATION METHODOLOGY

The action research methodology was used in this research. This methodology provides a constant iterative loop where new results might trigger a new research iteration based on the existing knowledge (Castro, C., n.d.). The action research methodology was applied, in particular, during the literature review process, to consolidate the know-how about D&A market, characterize the target audience and in providing a survey

to existing assistive products and technological resources for the creation of the online diagnostic model. The research process was structured in two phases with the following objectives:

- **1st phase:** the inquiry was presented to the associations, and through the interview technique, suggestions for improvement were collected. Following this interaction, the associations undertook to ask their members to complete the inquiry. The focus of the choice of the target audience was people who have psychomotor problems. Objectives of this phase: Receive inputs from associations regarding the formulation of the inquiry and its suitability for the target audience; Knowing in detail the target audience, their symptoms and pathologies, understanding the relationship with the D&A market, handle conventional devices daily and understanding what procedures they have adopted to adapt to the requirements of the market.
- **2nd phase:** Incorporated a set of knowledge and improvements, resulting from the analysis of the responses of the 1st phase inquiry, as well as the experience gained with the pre-prototype of the diagnostic model performed. The selection of the 5 interviews was obtained through the respective work sectors, that is, the connection between the entities that dealt closely with the target audience, professionally and socially (D&A companies, assistive product suppliers, associations, prescribers and the end-user). Through the technique of focus group and individual interviews, suggestions were made to improve the diagnostic model by stakeholders. The objective of this phase: Market validation and collection of recommendations for improvement of the diagnostic model regarding its usefulness, applicability and level of usability of the interface. Table 2 presents the total responses to the inquiry and interviews conducted in the first and second



phase of the analysis of this research work. Interviews provided feedback about the need to monitor the emotional states as a preventive measure, and companies saw in this research an opportunity to complement the elements that constitute the standard kit against the symptoms diagnosed in the employee.

The D&A sector was considered by employers to be very competitive and demanding in terms of creative work, with companies already contemplating innovative approaches, including the possibility of remote work, flexible working hours with management by objectives/deliveries.

Associations collaborated and validated the diagnostic model, providing suggestions in terms of parameters to analyze the benefits for the target audience, while the prescribers and suppliers validated the diagnostic model in assistive products and in the workplace.

In another phase of the action research methodology, the diagnostic model was taken to an investor contest "Born from knowledge 2019", mentors raised some doubts about the sale of the diagnostic model. This competition led to a look at the diagnostic model from a more commercial perspective regarding its market niche. From the result of the entities contacts through the market analysis, the final diagnostic model presented in Figure 1 and in Figure 2 was developed, adapted and improved based on the information of the interested parties. In the market analysis, the entities contacted rated the diagnostic model as 52.9% relevant.

## CONCLUSIONS

The research has studied the D&A market, in particular the adoption of vector and raster design tools, which require specific expertise in their use. Working with such design tools might become a significant constraint for people with psychosocial and psychomotor problems. In this domain,

the study outlines a niche of people in the D&A market to whom specific requirements addressing assistive products may be the key to improve their comfort and productivity at the workplace. The paper presented a set of statistical data, outlining the relevance of the topic from a social and socioeconomic point of view. Based on the research findings and in particular, the conclusion for interviews to stakeholders in the D&A market triggered the need for us to conceptualize a solution to address the identified social problem. The guiding principle was a social concern to mitigate the impact and to improve the inclusion and well-being of workers with temporary or permanent impairments.

The presented proposal for a diagnostic model was designed in collaboration with associations, assistive product suppliers, prescribers, D&A professionals and end-users, in order to standardize risk analysis procedures and at the same time incorporating recommendations regarding the severity of psychomotor and psychosocial constraint of the person analyzed. Investors left the information in order to put in place the construction and sale of the diagnostic model in the niche market. As the future work intends to develop, implement and test the diagnostic card system, display a plan (model canvas) for financing, so that this product can be developed. From there form a team and obtain a trade secret to protect the product's digital data. Finally, implement this model on a cloud server (web and mobile application) and, within a minimum period of 6 months, take actions to promote the sale of this product.

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# **SUPPORT4ALL - New to me, new to world; different contexts of new knowledge creation associated with design research and the development of new mass customizable devices for the treatment of cancer**



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## **Abstract**

As design practitioners working across a wide range of health related research and new product development areas we regularly need to learn the 'business' (language, culture and methods) of other disciplines. In health these can range from the specialist therapeutic strategies associated with a particular branch of oncology, to a specific service delivery aspect of a respiratory disorder, for example. In many ways, it can be said therefore that the development of new knowledge in these types of project happens in two distinct contexts. Firstly, in order for individual creative practitioners to 'invent' and subsequently design new solutions they must first build understandings of the disciplinary and subject specific challenges (and often use creative strategies to do that). In that first context, the individuals are acquiring 'new knowledge'; knowledge that may already exist in the world, but is new to the individual designer. This process is essential to both problem frame and problem solve. Design practitioners can then apply further creative strategies to manifest potential solutions to identified challenges, armed with that new knowledge. Secondly, arising from that first new knowledge context, (and usually following some refinement of potential solutions) ideas, devices or services can be tested to generate new knowledge in a second context, i.e. new knowledge in the world. Contributing to and extending the boundaries of human knowledge in significant, meaningful and original ways, is the mainstay of academia, and can be key to new product or service translation and implementation. These first and second context distinctions may at first seem obvious or even obtuse. However, in complex, technically challenging, and often highly specialised subject areas, design briefs that recognise a requirement for 'first context knowledge' can be shown to achieve much higher levels of success than those that do not. This paper reflects on one such challenging project brief, discusses what lessons have been learned and the methods used to build 'first context knowledge'. It then describes the mechanisms and practices used to generate 'second context', new to world knowledge. The research case study has led to a new design of customisable bra targeting increases in the technical accuracy of breast cancer radiotherapy delivery, and that improve the patient

experience, for those prescribed this often distressing treatment. Every day around 130 women in the UK will be told they have breast cancer. Globally around 1.5 million women are diagnosed with the disease annually. So with over 80% of women surviving breast cancer beyond five years (2017), our aim was to improve the delivery of treatments and reduce side effects for women living beyond their cancer. The challenge is a global one. Yet, on an individual basis each patient is different, not only in terms of body shape and size, but in regard to how they may be treated, and the treatment pathway. In this respect a significant part of the design challenge was how to address such a 'mass customisation' issue. And how do designers become 'expert enough' in specialist clinical matters, to ensure technical and acceptance issue success? The work has resulted in a clinical data set derived from a formal Clinical Feasibility Trial, whereby 25 post-operative (lumpectomy) breast cancer patients agreed to wear and be treated with radiotherapy in the new bra design. As a whole we can show that second context (significant, meaningful and original) new knowledge has been generated as a direct result, of the facilitation of the development of 'first context knowledge'.

**Keywords****Cancer, Customized therapies, Products, Design, Knowledge**

# Naturalistic Observations of Elderly in an Outdoor Environment

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## Abstract

Assistive technology is a promising solution to enhance the wellbeing of people, especially the elderly. Elderly people face hazards and barriers that prevent them from being active and performing outdoor daily living activities (Barnsley et al., 2012). Most ambient assistive living research focuses on indoor environments (i.e., home) using information from sensors in the environment and on the person (Rashidi & Mihailidis, 2013). However, if the solutions can be implemented in an outdoor scale, the elderly can perform more outdoor activities. This can play an essential role in increasing the quality of life and autonomy of the elderly. Mostly, outdoor assistive technologies are based on wearable devices that the elderly do not feel comfortable wearing (Li et al., 2018). The main goal of the project is to provide a review of existing interventions to improve the wellbeing of elderly people in an outdoor environment and how technology may help them in a smart outdoor by adapting the environment to the user instead of adapting the user to the environment. In this sense, for this paper, naturalistic observations were done to understand the behavior of the elderly in a specific outdoor in Lisbon. An analysis of behaviors, patterns, activity flows will be analyzed to obtain opportunities to introduce assistive technologies.

## METHOD

Observations were made in a public and open park in Lisbon, during a couple and consecutive days, in different hours, trying not to create a connection or to be recognized by users. Through the anonymous observations, it was expected that the behavior of the users will not be influenced by the observer. By the observations, the needs of the users and the interaction between the environment and the users will be analysed in a matrix.

## OUTDOOR SELECTION

This park was selected based on the high concentration of elderly people in this neighborhood, and also some geographic and urbanistic conditions as, being a flat part of the city, well connected with the city

center by public transportation.

#### SAMPLE

The sample of this study are the elderly users of this park, mostly people between 60 and 80 years. 20 females and 30 males were observed in different areas of the park.

#### APPARATUS

The layout of the space was used to identify the areas and create connections between users and spaces considering sunlight position, water points, shops, and paths. A smart phone was used to visualize the park through videos and photos. Moreover, an observation sheet was also filled during the recordings to define specific actions, time and opportunities in the park by analyzing the behaviors.

#### PROCEDURE

The observer sat in various places to provide elevation to view elderly and obtain patterns of behaviors regarding 6 different areas (i.e., sitting/resting area; artificial lake; kids' playground; gazebo; café; leisure) of the space. The observer also took notes of the number of times a certain behavior occurred in a specific period of time.

#### RESULTS

We are finalizing collecting the data now and we expect to have the results analyzed by November 2019.

#### Keywords

**Smart Outdoors, elderly, naturalistic observations, ambient assistive living**

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# Designing for affective and ludic experiences with empathy

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## Abstract

In the context of the holistic view of experience (Hassenzahl, 2011), the concepts of pleasure, fun and empathy are introduced as an added layer of meaning to User Experience. With the importance of the study of emotion linked to design and empathy gaining more traction in both academia and practice, they are addressed both historically and conceptually, finding various theories of emotion from neuroscience, biology and psychology (Damásio, 2004; Ekman, 2016; Plutchik, 2003) as well with their role and relevance in design practices (Hanington, 2017; Hook, 2013; Norman, 2004a). Experience, emotion and fun are dependent, beyond designers' intent, on personal and cultural experiences and interpretation, indicating a need for experiences that are more personalized or that consider these personal contexts. Thus, the role of personas is considered as a methodology that dialogues with the role of emotions in understanding users' experiences and as a facilitating tool for empathy between user-designer or designer-team (Nielsen, 2019; Norman, 2004b). Through a series of interviews, a gap between the importance given in the literature to empathy, fun and emotions and the practitioners' experience and application is found. In conclusion, we consider that Experience processes are still focused on responding to usability and usage needs and are less devoted or concerned in including emotions, pleasurable experiences or fun.

## Keywords:

Experience and Interaction Design; Emotion; Ludic Experience; Empathy; Personas.

## INTRODUCTION

With the rise of Experience related professions and academic research on the subject, and in the context of a holistic view of Experience (Hassenzahl, 2011), the concepts of pleasure, fun, and empathy are introduced as an added layer of meaning to User Experience. Reflecting into what distinguishes experiences from regular “usage” it’s necessary to understand it’s potential and the status of its current application.

Experience design is still very focused on making life easier for the user, neglecting other parts of what constitutes an experience like inciting emotions and delivering ludic interactions. In this context, it is necessary to understand how to design for other experience components like emotions and fun, understanding their role in the design process, and its impact on users’, only then will the potential of Experience Design be achieved. Therefore, an investigation on topics that are a part of designing for experiences but are not as well adapted to common practice, such as affective and ludic experiences, was deemed relevant.

The study of emotion linked to design and empathy is gaining more traction in both academia and practice, they are addressed both historically and conceptually, finding various theories of emotion from neuroscience, biology, and psychology (Damásio, 2004; Ekman, 2016; Plutchik, 2003) as well with their role and relevance in design practices (Hanington, 2017; Hook, 2013; Norman, 2004a). Both Affective and Ludic experiences share a body of research into understanding and addressing human behaviours, psychological states, and motivations. By affective experiences, we mean all kinds of subjective experiences that involve the concepts of pleasure, appraisal and emotions (Desmet & Hekkert, 2007), and other concepts brought with the rise of Affective Sciences. Ludic experiences

are also addressed, making the case for greater inclusion of concepts like fun, play, motivation, and engagement. As well as being rooted in social and cultural contexts, they create a need for a greater understanding of the role of the user/ player and their specific settings, indicating a need for experiences that are more personalized or that have in mind these personal contexts. To this intent, the potential of the Personas methodology is considered as a facilitator for the focus of empathy in the design process (Norman, 2004b). With the increasing need to understand people, be them users or players, we advocate for the need for empathy as a guide for designing experiences, especially when considering personalization efforts. Designers can only construct ‘complete’ experiences with the help of empathy. Since experience, emotion and fun are dependent, beyond designers’ intent, on personal and cultural experiences and personal interpretation, there is a need for experiences that are more personalized or that consider these personal contexts.

## REFLECTIONS ON THE ROLE OF EMOTIONS AND FUN IN EXPERIENCE DESIGN

When reflecting on the rise of Experience as a design concept, one must take into account the transition between the focus in human behaviour and cognition to the recent understanding of Human Computer interaction (HCI) brought by the “experience model”, that includes a greater dialogue with the users’ affective experiences. In User experience and experience design, Marc Hassenzahl presents Experience Design (XD) “(...) as stories told through products”(2011, p. 85) and adding “an experience is subjective, holistic,

situated, dynamic, and worthwhile”(Ibid. 2011, p. 72), mentioning the numerous definitions connected to the word “experience” and how to translate them for design practices. Desmet and Hekkert (2007) also abide by this perspective, being that the experience is not a property of an object but the result of the interaction between an agent and an artefact. They also divide product experience into three levels, aesthetic pleasure, attribution of meaning and emotional interaction, in which the experience “(...) is the interpretation of an event (or product), rather than the event itself, which causes the emotion” (Ibid. 2007, p. 61). These definitions offer a lot of freedom when defining an experience, being perceived more as a perspective for the creation of immaterial value. Experience design prioritizes the discovery of meaning and motivations, and covers not only the creation of the experience but also it’s shaping (Hassenzahl, 2011). When discussing how to create experiences Sanders and Dandavate (1999) mention the difference between designing experiences and “designing for experiencing”, being that an experience is always built upon another, and so is dependent on context, including other factors independent of the one being designed. To this end it’s deemed necessary to have a greater understanding of the user, beyond the tasks that are needed, being the (experience) designer’s role to defend the importance of understanding people and users to whom the products are being designed for. The use of the term “affective experiences”, has been spread with the rise of affective sciences and neuroaesthetics, and their integration in product design. According to Hook (2013), this field is approached differently by three currents, the third, nicknamed technology as experience, argues that emotion is only part of the study of a larger group of experience rather than a separate field and is advocated by John McCarthy, Peter Wright, Marc Hassenzahl and Don Norman. Desmet and Hekkert (2007) define

affective experiences or affective states in terms of subjective experiences that are valenced, meaning that can be assessed through a scale between two concepts. The authors suggest four variables to reach “an emotional experience” – concern, stimulus, appraisal and emotion, which is dependent on the previous three. Therefore, to design for the affective experience one must include emotions as a unifying element. The concern with emotion in HCI from an historical point of view is addressed by Hanington (2017), mentioning that “Design and emotion” as a movement started to gain traction in the 80’s but rose to importance in the 90’s with the emergence of personal technologies for everyday use, this was a branching point for concepts like fun and pleasure for user experience in HCI providing a different path for a traditional focus on usability.

In order to design for emotions, one must contextualize them in the fields of Psychology and even in the study of the human mind, be it that even in these fields there isn’t much consensus in their definition. According to Ekman (2016) there are two greater perspectives on emotion, one argues that emotions are modular, independent and aren’t comparable to another, and the other argues for emotion as dynamic in valences being evaluated in two axis: pleasant-unpleasant and high intensity-low intensity. But there is a third perspective that combines the two, making emotions independent and modular but also dynamic, Plutchik’s (2003) theory and “Wheel of emotions” is an example of the relationships between the various basic emotions, the combinations resulting from their interaction and their intensity. Damásio’s (2004) argument for the intrinsic relation between the cognitive and the emotional, arguing that emotions are also governed by the cognitive state and aren’t just instinctive or a product of evolution. This thesis also considers that an emotional reaction comes from an “emotional competent stimulus”, “(...) an

object or a situation actually perceived or recalled from memory" (Ibid. 2004, p. 50), that can be conscious or unconscious, but that causes an automatic reaction. This depends on evolutionary factors, context, and personal or autobiographical history. The same stimulus can also lead to another emotional reaction dependent on personal experiences and can change over time. This approach is reflected in Norman's work, *Emotional Design - Why we love (or hate) everyday things* (2004a), that includes emotions in the affective system by affirming that "emotion is the conscious experience of affect, complete with attribution of its cause and identification of its object" (2004a, p. 12). In "What Scientists Who Study Emotion Agree About" (Ekman, 2016), multiple authors are inquired about the modern study of emotions, this presents a series of concepts like the acceptance of emotions or signals (facial or vocal) that are considered 'basic' or 'universal' in which five were more consensual – anger, fear, sadness, joy and disgust. Even though these five are the ones that gather the most consensus, and that Ekman has considered universal (Ekman & Cordaro, 2011) there are also others that could be a part of that group. Desmet also distinguished emotions from moods, being that emotions are "acute states that exist only for a relatively short period of time" (Desmet, 2003, p. 7) and that are intentional, as with moods tend to perdure through time and that the individual might not be conscious of them.

It's not possible to talk about ludic experiences without emotion. They encompass playfulness, play, games and gamefulness, all of those are linked to emotions but distinct in their nature, Stenros states "this playfulness is shared, it becomes socially framed, play emerges, and as these shared forms are codified, we call them games" (2014, p. 201). Being playful is a state or mental perspective of a biological nature that goes beyond the boundaries between species, cultures and languages, Stenros also

suggests this phenomenon is almost a 'need' or an impulse, intentional or conscious, it is a behaviour that is inherent in social animals and in group behaviours. This state is dominated by spontaneity and freedom, where there are no goals or rules or purpose, but it evolves and changes according to the individual's willingness (McGonigal, 2014, p. 654).

Players seek in games activities, sensations, emotions and experiences that they can't experience in real life (Lazzaro, 2004a). The 'magic circle of play' provides a safe space and freedom, and that fosters openness to new emotions, autonomy and willingness to express them, thus creating a 'safe' space to develop affective experiences (Yannakakis & Paiva, 2014). Shell (2008) argues in his definition of Fun that this concept is a combined emotional state, by merging the emotions of surprise and pleasure. The experience of Fun is linked to emotion, and is also one of the main ingredients associated with play, games and playful objects, as Radoff states: "This fun comes about because of the emotional content of the game—something that happens when you connect the gameplay with peoples' passions, interests, and imagination" (2011, p. 147), the author also links the development of fun with an emotional stimulus, through an attempt to please personal contexts.

Nicole Lazzaro (2004b) in "Why We Play Games: Four Keys to More Emotion Without Story", finds links between different types of fun in games without story and correspondent emotions, the four types being hard fun, easy fun, altered states of cognition, and the people factor. These links show that even though fun is not a universal emotion, considering that is the result of other combinations and so not eligible according to Ekman (Ekman & Cordaro, 2011), it is still a big part in how we perceive activities as social beings and how playfulness can be found in any activity as long as its engaged with the right state of mind

and wiliness. Isbister (2016) also makes the case for the role of games in the study and design of emotions in her book *How Games Move Us: Emotion by Design*, stating that games encourage emotional experiences over time and through the intentional action of playing, but these emotional characteristics are not visible to an observer who is not involved in the experience.

## DESIGNING WITH EMPATHY IN MIND

Empathy as a concept is related to sensibility, perception, understanding, and recognition of others and their emotions and behaviours (Gasparini, 2015; Kouprie & Visser, 2009; Wright & McCarthy, 2008). Empathy in the context of psychology is divided in two manners, “emotional” or “affective” empathy, and “cognitive” empathy. Emotional or affective empathy deals with a response to an emotional stimulus, as an instinctive process that searches for common points when sharing or re-enacting the experience. While cognitive empathy is related to the mental process of being conscient and gaining an understand of the other, and their viewpoints, while trying to understand the experience they faced (Cuff, Brown, Taylor, & Howat, 2016; Gasparini, 2015; Kouprie & Visser, 2009). One of the potential questions about the validity of these exercises is the ‘empathic horizon’, a concept that indicates the limits of an individual’s ability to empathize after some boundaries are reached - such as nationality, age, gender, culture, experience, and education. This horizon, however, can be changed by time, experience and training (Kouprie & Visser, 2009).

There is a common misunderstanding between the concept of empathy and its application in Experience and UX Design that, in many cases, is more related to sympathy rather than empathy.

Sympathy is the “recognition of other’s pain”, this approach is the first step to achieve empathy. While empathy is considered “the ability to fully understand, mirror, then share another person’s expressions, needs, and motivations.” (Gibbons, 2019). This distinction is also established by Kouprie and Visser (2009), who claim that sympathy is an absorbed feeling while empathy is an “instrumental understanding”. In this manner, empathy is limited towards a specific person at a time or a range of people, that shared the same experiences. In the context of UX, one cannot empathize with all potential users, being that this range is not specific enough to distinguish different perspectives or interactions that would help to construct an understanding.

Empathy can be integrated into design practice in two ways, as a tool – developing objectives, identifying and classifying different emotions and their potential reach - or as a method – serving as a guide to the research about the user and understanding the problem to be solved (Gasparini, 2015). Designers must recognize and identify users’ feelings and be able to understand and communicate them as if they were their own, without losing their perspective. This “detachment” concept is addressed by Kouprie and Visser (2009) in their framework, that includes four steps to help to design with empathy: Discovery, Immersion, Connection, and Detachment. It also covers some pitfalls related to the limits of empathy by providing the distance to reflect and add value. The authors also reflect on three key points for the success of empathy in design: the motivation of all involved in the process and the understanding of the goals in using empathy; understanding both the concept of the cognitive side and the emotional or affective side of empathy; and that the process of empathy in design requires time and disposition (Ibid. 2009).

The role of imagination and identity is also significant when trying to understand and recognize others experiences, one eventually resorts to imagination as a means to re-enact this fictitious situation, as stated by Wright e McCarthy (2008). Personas are considered as an experience design facilitator for empathy by focusing the “imagination” and adding data from real users into account.

Personas are model representations of a set of archetypes - fictions and characters made to represent and understand the target users following product evolution - based on behavioural, ethnographic and demographic data (Adlin & Pruitt, 2010; Alan, Reimann, & Cronin, 2003; Nielsen, 2014). Lene Nielsen (2019), characterizes various conceptual perspectives to persona applications and methodologies. Distinguishing Cooper’s “Goal-directed perspective”, the “Role-based perspective” outlined by Grudin, Pruitt and Adlin, her own “Engaging perspective” and the “Fiction-based perspective” mentioned by Blythe. Despite differences in methodology, these authors mention the importance of representing user segments and their materialization into fictional characters that represent them and by which design decisions can be made to guide the process.

Personas are used in concurrence with other User Centered Design (UCD) tools and methods and play a small part in the Experience process. Although they are developed at an early stage and can be created through data-based conjectures, they should play an active role throughout the production and development cycle. According to Pruitt and Aldin, the main advantages of personas are: (a) their ability to create a common reference on which to base assumptions and arguments about users; (b) to allow the designer to focus on a (small) group of users, avoiding self-referencing

as motivation; (c) help develop empathy for users (Adlin & Pruitt, 2010); This link between personas and empathy is also pointed by Norman (2004b) stating that empathy is the objective and major virtue of personas and is developed through the process of their creation and communication with stakeholders. Even non-data-driven personas - Assumption, Ad-hoc or Proto personas - can still be useful when user data is not accessible, being that even without data collection and assumptions they still retain their goal as a tool for developing empathy and an understanding of other people perspective that other methods fail to achieve (Norman, 2004b; Pruitt & Adlin, 2006). Even though there have been several discussions about the effectiveness and several pitfalls of Personas, they can be validated as a process to attain empathy by the designer/team.

The advantage of Personas lies in making abstract users seem human; to transform data into personal characteristics and focus design towards a character, and that enables more humane products. With the arrival of digital data-driven personas (DDDPs) and their automated processes of persona development based on big data analytics (Jung, Salminen, Kwak, An, & Jansen apud (Nielsen, 2019)), as a response to persona’s criticism, this methodology focuses on rapid and organized creation at the expense of human construction and a manual approach, prioritizing efficiency and accuracy over direct contact with users and empathy.

The emerging trend of personalized experiences and the rise of big data and data analytics reveals a pressing need to humanize users and to create meaningful and personal experiences that are, at their core, human. Through these and previous arguments, it’s shown there is a need to design for emotions and to design with empathy. Empathy can be a way to unlock emotion’s potential in design practices and guide their process.



## DESIGNERS EXPERIENCE ABOUT EMPATHY, PERSONAS AND THE RELEVANCE OF EMOTIONS AND FUN.

As a form of reflection on current practices a qualitative semi-structured interview was made to 9 practitioners of various nationalities, companies, and roles in the UX process to understand their experiences with personas, empathy, emotion, fun, and how can we integrate these elements in personas. In the development of the interviews, three questions were considered. The first one gauged the interviewees' personal opinion about the personas method, the second the role of empathy in the User Experience process and the third if they considered that there was an investment in the concepts of fun, pleasure and emotion in the UX field. The elements of comparison between respondents were analysed according to qualitative answers to the questions and according to relevant themes raised during the interviews.

The first question aims to inquire about the relevance of personas methodology in relation to the interviewees' practices. Although some respondents (E3, E4, E5, E7, E8) report that they always consider the relevance of the methodology depending on the conditions attached to each case, most indicate that they are useful and use them in their projects, especially in projects of great complexity.

The second question addresses the opinion regarding to the role of empathy, in their process and in the UX field in general. All interviewees refer that they tend to use empathy in their personal process, for example, "I think UX without empathy doesn't work" and another reaching from her psychology background, saying "(...) And maybe in this knowledge of the details eventually gives us empathy but it's quite a complicated

process." The appraisal by interviewees of its application on UX processes in the industry, shows that 56% consider Empathy relevant in the UX processes and 11% consider it not relevant. As with other concepts like fun, pleasure, and emotion interviewees, responding to the third question, were more reluctant in their relevance making it very dependent on the context, stated in Table 1. Quoting, "Many times we don't want people to have fun but make something useful" or "In my company Fun, pleasure and emotions is faced as a design thing and not as an experience thing which is a shame".

Table 1 - Question three results

### Q3. Do you consider that the UX field addresses concepts like fun, pleasure and emotion?

	E1	E2	E3	E4	E5	E6	E7	E8	E9	Total
<i>Fun</i>	x				x		x		x	4
<i>Pleasure</i>	x				x		x	x	x	5
<i>Emotion</i>	x				x		x		x	4
<i>Depends on the context</i>		x	x	x		x		x		5

Most interviewees said they were familiar with these concepts but don't always apply them in their process or projects. The interview results also reflect a difference between the importance given in the literature to empathy, fun and emotions and their perception of its application in the industry. There is a significant difference in the interviewees perception of the importance of empathy, fun and emotions in UX processes in the industry and their personal practice. This sample albeit small, shows that all interviewees considered empathy relevant in their practice but only five out of nine considered empathy relevant in the industry.



## CONCLUSION

We need to consider the User/person/player's role in UX processes not only through the perspective of tasks/objectives or usability. As that covers only partially what we consider as an experience, as that covers only partially what we consider as an experience, and that's where empathy can be applied. To design for affective and ludic experiences is to design with empathy keeping emotions in mind, and should consider their impact as part of the user experience including the adopting concepts like - pleasure, aesthetics, and ludic qualities like joy, surprise, excitement, fun and exploration. By understanding emotions considered universal, we must also strive to combined emotional states, like fun, through design, since the value given to objects is also their perceived emotional value to the user and not only its ability to perform a function (Chapman, 2009; Norman, 2004a).

Designers can only construct 'complete' experiences with the help of empathy, by understanding personal considerations linked to experiences. Applying Empathy or an empathic understanding is crucial in design practices, be it in its inclusion through processes, methodologies or as a guide for better practices.

Thus, Personas are considered as a methodology that dialogues with the emotion's role in understanding users' experiences and as a facilitating tool for empathy between user-designer or designer-team (Nielsen, 2019; Norman, 2004b). By using a familiar methodology, we can include tools to bridge the gap between practice and theory and to insert more emotion and fun into all experiences.

In conclusion the importance and relevance given in literature to empathy, emotions, pleasurable experiences or fun is observed on the interviewees practice. Nonetheless the

perception of User Experience processes in the industry is that they are still focused on responding to usability and user needs and are less devoted or concerned with empathy, emotions, pleasurable experiences or fun.

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# Designing robotic safety assistants: A survey on the influence of morphology and appearance on social robots



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## Abstract

The idea of having service robots as assistants in safety and/or security tasks is becoming popular these days, mostly due to several advantages such as their capability to bridge the gap between traditional security/safety measures (e.g., cameras, access control) and manned guards. Moreover, these robots can operate 24-hours per day and do patrols under conditions that would be critical for human operation; e.g., low-visibility and in hazardous conditions (e.g., chemical substances, radiation, falling objects). Also, if connected to the general security/safety systems, while in an IoT network, the robot could not only monitor the events happening in the surroundings, fuse its sensors data, but also decide the course of action by making use of artificial intelligence capabilities. By doing this during an emergency egress, for example, the robot would know the most optimal available escape routes, in real-time, increasing the odds of saving lives. However, to be successful, the humans must decide to follow the robot's indications and such decision is related with the physical appearance of the robot. We argue that service robots that are capable of acting in an empathic manner, which affects trust, are more successful as security/safety assistants, while in an emergency egress. In this context, this paper presents a study where we evaluated the participants' subjective preferences about different types of service robots presented as variants to act as security/safety assistants. The results from this study will be informative for a second study in which we aim to assess the participants' behaviour in response to a service robot, while exposed to a simulated hazardous event (e.g., fire) simulated in a virtual reality setting.

### Keywords:

**Trust, Human-Robot Interaction, User-Centered Design**

## INTRODUCTION

In 1949, Gray Walter, a neurologist and pioneer in robotics, developed two robotic “turtles”, Elmer and Elsie. These artefacts responded to two stimuli: light and touch, which allowed them to navigate the scientist’s room recognizing obstacles and, consequently, bypassing them. This was the first case reported in the history of interaction between two machines and the world around them, as turtles could read the world, albeit in a very primitive way, but enough so that they could navigate without colliding with objects. These robots were early attempts to create the so-called Social Robots, defined by Dautenhahn and Billard (1999) as “(...) embodied agents that are part of a heterogeneous group: a society of robots or humans. They can recognize each other and engage in social interactions, they possess histories (perceive and interpret the world in terms of their own experience), and they explicitly communicate with and learn from each other.”

As the popularity of social robots increases, appropriate ways to design them should be empirically explored. In this study, we investigated trust in socially interactive robots by looking into their morphology (i.e. humanoid, zoomorphic or machine-like). Because the robots’ role and context of use matters for the development of trust, for this study we selected the context of emergency egress in a complex building in which the robot is intended to assist people to escape with safety. The lack of studies and findings of the development of trust in social interactive robots motivated this study.

According to Breazeal (2003), social robots can be categorized into four classes: socially evocative, social interface, socially receptive, and sociable, according to (1) how well the robot can support the social model that is ascribed to it and (2) the complexity of the interaction scenario that can be supported as follows. Fong, Nourbakhsh and Dautenhahn (2003) use the term social interactive robot, according to exhibit the following “human social” characteristics: (i) express and/or perceive emotions; (ii) communicate with high-level dialogue; (iii) learn/recognize models of other agents; (iv) establish/maintain social relationships; (v) use natural cues (gaze, gestures, etc.); (vi) exhibit distinctive personality and character; (vii) may learn/develop social competencies.

Socially interactive robots usually operate as partners, peers or assistants, interacting with a wide range of humans (Fong et al., 2003) in diverse contexts and with different purposes, from large public environments such as museums (e.g., Nourbakhsh et al., 1999) or healthcare-related facilities

(e.g., Pineau, Montemerlo, Pollack, Roy, & Thrun, 2003) to domestic environments. For a good Human-Robot-Interaction (HRI), great adaptability and flexibility are required capabilities, as well as an adequate appearance and behaviour, which have been suggested as critical for their success.

During an emergency egress, the robot will not only be required to work as an assistant, suggesting safe paths towards the exit but, in some cases, they will be required to work as a “persuasive machines” (Fogg, 2009) since a successful escape might require change people behaviour or attitude. For example, it is well established that during emergency egress people are influenced by architectural features (e.g., Vilar, Rebelo, Noriega, Duarte, & Mayhorn, 2014; Vilar, Rebelo, Noriega, Teles, & Mayhorn, 2015) and tend to use the same routes travelled when entering the buildings, which might not be the safest options. Thus, the robot should be able to influence/change these route decisions in case they are not advisable.

In this context, trust is a key topic since, to be willing to accept robots instructions/direction, humans must trust that the robot will protect their interests and welfare of every other individual on the team (Hancock et al., 2011). This will even be more critical in high-risk situations/environments, such as combat missions (Groom & Nass, 2007) or in other emergencies, that jeopardises human integrity and are characterized by uncertainty (Park, Jenkins, & Jiang, 2008). However, the trust in a robot is proven to be a complex issue, being dependent on various factors with diverse power. According to Hancock et al. (2011), performance-based factors (such as behaviour) and attribute-based factors (such as appearance and behaviour) are relevant on the development of trust, with the former playing a stronger effect than the latest. Environmental factors and users individual variables (e.g., previous experiences with robots, age groups, cultural backgrounds) (e.g., Ljungblad, Nylander, & Nørgaard, 2011) were also found to have some influence. Although the literature is somewhat scarce about the influence of the robots’ physical appearance it is known that the appearance, which comprises several different variables such as the robot’s morphology or its size actually, biases the interaction. Fong et al. (2003) argue that “the form and structure of a robot are important because it helps establish social expectations”, adding the example that “a robot that resembles a dog will be treated differently (at least initially) than one which is anthropomorphic.” Thus, morphology should be one of the first factors to consider when designing a social robot.

Like other products we use every day, the shape of the

robot should be related to its function, allowing the user to more easily structure a relationship and interaction with it. Fong et al. (2003) classify robots into four morphological categories: 1) functional (functional or machine-like robots), 2) anthropomorphic (humanoid-like robots), 3) zoomorphic (animal-like robots) and caricatured (cartoon-like or doll-like robots). Yanco and Drury (2002) suggest eliminating caricatured robots, as they generally tended to resemble animals, humans or machines. The anthropomorphism in HRI is suggested to create a sense of familiarity, making it easier for the user to read the artefact behaviourally, since its actions/behaviours are expected to resemble a person, thus creating the illusion that the robots are more sophisticated than they are (DiSalvo & Gemperle, 2003). However, the risk of people negatively react to human-like robots is well known since the presentation of the Uncanny Valley (Mori, 1970). Nevertheless, there is a lack of empirical evidence on the topic (Rosenthal-von der Pütten & Krämer, 2015).

## METHOD

Three research questions were addressed in this study: (a) What morphologic model transmits more trust in an emergency scenario? (b) Does the gender, age and participant's past experiences with robots influence their morphology choice? (c) What physical characteristics should the robot have (e.g., arms, legs, eyes) to maximize perceived trust in an emergency scenario? A survey, built with Qualtrics, was conducted to explore participants' perceptions and preferences about the robots' appearance. The online version questionnaire was only available in desktop, as in smaller smartphone screens the images could not be visualized simultaneously, which could bias the answers. The questionnaire, which was launched during November 2018, was disseminated in two ways: face-to-face and online (e.g., Facebook groups). The face-to-face sessions were held at IADE, Universidade Europeia and DGAE - Direção-Geral da Administração Escolar, Lisbon, Portugal.

## PARTICIPANTS

In total 130 people participated in this study, however, only 125 were considered in the analysis because five were excluded due to age limits (i.e., 2 below 18 years old and 3 above 65 years old). Participants were aged between 18 and 64 years old, with a distribution per age group as

follows: 18 to 24 years old (34 participants); 25 to 34 years old (21 participants); 35 to 44 years old (12 participants); 45 to 54 years old (38 participants) and 55 to 64 years old (20 participants), 60 were males and 65 females.

## QUESTIONNAIRE AND STIMULUS

At the beginning of the questionnaire, after giving their consent to participate, participants were asked their demographic data (i.e., gender, age group, educational qualifications and professional status), followed by their past experience with robots, gathered a Portuguese version of NARS (Negative Attitudes Towards Robots) (Piçarra, Giger, Pochwatko, & Gonçalves, 2015). Subsequently, participants were given an emergency context scenario and presented with 12 pictures of different robots (i.e. 4 anthropomorphic, 4 functional and 4 zoomorphic) in random order, with neutral colours (i.e. grayscale) in white backgrounds to avoid bias, which they should analyse and select regarding morphology and appearance. The robots models shown were: Atlas, Wakamaru, Asimo and Pepper (human-like models); Hexa, SpotMini, Paro and Aibo (animal-like models); Relay, Roomba, M1 and LDG-PIRSC8 (machine-like models).

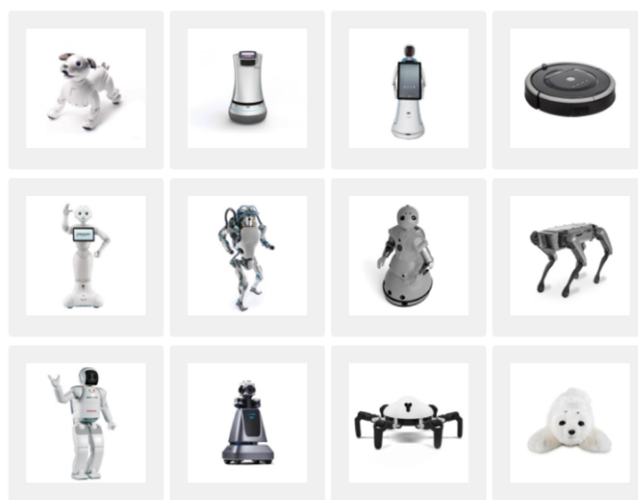


Figure 1: Robot models available for the participant to choose the preferred morphology for an assistant robot during emergency egress

To assess participants' preference regarding morphology, participants were asked to select the robot they would entrust to escort him/her to safety during the emergency egress. After the selection is made, participants were shown several physical characteristics, based on the previous choice, which was the most common found in the literature;



i.e., eyes, mouth, arms, legs, gender and size of the robot. They were asked to rate each physical characteristic as positive, negative or non-relevant to build a close-to-ideal of a trustworthy robot model.

## RESULTS

All statistical analyses were performed with the software IBM SPSS v.25 and a significance level of 5% was considered.

### MORPHOLOGY

Results show that the most voted robot morphology is the anthropomorphic (human-like robot), with 57,6% of the preferences, as can be observed in tables 1 and 2. The favourite robot models were Asimo (29 votes), an astronaut-like robot and Pepper (21 votes), a guide robot with a screen.

Table 1: Robot morphology choice by age.

Age Groups	Human-like Robot	Machine-like Robot	Animal-like Robot	Total
18-24 years	12 (9,6%)	13 (10,4%)	9 (7,2%)	34 (27,2%)
25-34 years	12 (9,6%)	7 (5,6%)	2 (1,6%)	21 (16,8%)
35-44 years	10 (8%)	1 (0,8%)	1 (0,8%)	12 (9,6%)
45-54 years	26 (20,8%)	4 (3,2%)	8 (6,4%)	38 (30,4%)
55-64 years	12 (9,6%)	5 (4%)	3 (2,4%)	20 (16%)
Total	72 (57,6%)	30 (24%)	23 (18,4%)	125 (100%)

Table 2: Robot morphology choice by gender.

Gender	Human-like Robot	Machine-like Robot	Animal-like Robot	Total
Male	32 (25,6%)	13 (10,4%)	15 (12%)	60 (48%)
Female	40 (32%)	17 (13,6%)	8 (6,4%)	65 (52%)
Total	72 (57,6%)	30 (24%)	23 (18,4%)	125 (100%)

### DEMOGRAPHICS CORRELATION

To understand if (a) gender influenced the choice of robot type in the emergency, an independent T-test was performed. The results of this test are obtained through the analysis of the Lavene equality of variance test, and if the significance is greater than 0.05, the difference between the group means is not significantly different. Regarding (b) age, since it has more than three unrelated groups, the One-Way ANOVA test was used, whose interpretation is similar to independent t-test. To analyse the negative attitudes towards robots a validated Portuguese version of NARS was used (Piçarra *et al.*, 2015). The NARS was therefore divided into two factors: (c) attitudes towards robot interaction and

(d) attitudes toward robot interaction with human traits. Like the (b) age, these factors were also analysed using the One-Way ANOVA test.

The results are: (a) Gender:  $t(123) = 1.501$ ;  $p = 0.136$ . No statistically significant difference was found regarding gender; (b) Age:  $F(2) = 3,620$ ;  $p = 0.030$ . A statistically significant difference was found regarding age, suggesting that age influences the robot choice in the emergency scenario; (c) Attitudes towards robot interaction:  $F(2) = 1,163$ ;  $p = 0.316$ . No statistically significant difference was found regarding attitudes towards robots; (d) Attitudes toward robot interaction with human traits:  $F(2) = 3,620$ ;  $p = 0.030$ . No statistically significant difference was found regarding attitudes toward robot interaction with human traits. In summary, apart from age, the results don't show that the choice of morphology was influenced by any of the assessed factors. A closer analysis suggests younger age groups trust anthropomorphic robots almost as much as functional robots, however, since the human-like robot is still the predominant choice in all the age groups, with 57.6% of all votes, we find the age correlation non-significant.

### PHYSICAL CHARACTERISTICS

Qualtrics's crosstabs functionality was used to analyse the physical characteristics. Only the anthropomorphic robot was analysed since it was the overall preferred (most-voted, with 77 votes). We asked the participants to "build" a robot, marking the characteristics presented as a "Yes", "No" or "non-relevant". The characteristics presented in the questionnaire were: eyes, mouth, gender, arms, legs and size.

As can be observed in Table 3, the majority of participants preferred an anthropomorphic model with eyes. No participant selected the option without eyes. The mouth and arms also appear to be relevant to the participants. The legs don't seem to be as much relevant as the "no" and "non-relevant" responses are higher than the positive one. The gender is also found non-relevant, with 55 (71,4%) participants marking it as non-relevant. Lastly, regarding the size, the "smaller than me", "about my size" and "non-relevant" responses percentage were similar. Further analysis should be conducted to fine-tune the identification of the adequate size, however, these results suggest the participants do not like robots larger than them.

Table 3: Physical characteristics crosstab analysis.

Physical Characteristic	Yes	No	Non-relevant	
Eyes	67 (87%)	0 (0%)	10 (13%)	
Mouth	57 (74%)	6 (7,8%)	14 (10,2%)	
Arms	67 (87%)	2 (2,6%)	8 (10,4%)	
Legs	35 (45,5%)	15 (19,5%)	27 (35%)	
Physical Characteristic	Male	Female	Non-relevant	
Gender	12 (15,6%)	10 (13%)	55 (71,4%)	
Physical Characteristic	Bigger then me	Smaller than me	About my Size	Non-relevant
Size	2 (2,6%)	26 (33,8%)	29 (37,7%)	20 (26%)

## CONCLUSIONS

We examined people preferences concerning morphology and appearance of social interactive robots intended to be used as safety assistants during an emergency egress scenario. The results showed a preference anthropomorphic robot model; i.e., a human-like robot, with eyes, mouth and arms, corroborating previous studies findings (e.g., Goetz, Kiesler, & Powers, 2003; Ramey, 2006). The results also demonstrate that participants' age, gender and past experiences with robots do not influence either the choice of morphology or appearance. As for the robots' gender and the legs, they were not relevant for the participants. As for the robot size, as expected, almost no participant chose a robot bigger than him/her.

Although the small sample size, that can limit the validity of these findings, these results will be useful to design a social interactive robot to be used on a larger study that will test the trust on robots during an emergency egress simulated using virtual reality, similar to the experiment conducted by Robinette, Vela and Howard (2012).

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# The Unnoticed Importance of Post-Processing in Videogame Development

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## Abstract

This article investigates the importance and usefulness of using Post-Processing in videogame development, as well as its recognition as a valuable skill to have as a game developer. To do so, articles, interviews, conferences and games (such as, Mass Effect 3 , The Witcher 3: The Wild Hunt , Ōkami , Borderlands 3 , Need for Speed Heat , Assassin's Creed IV: Black Flag and Rise of the Tomb Raider ) were analysed. It must however be noted, that, considering the length of the paper, the analysis performed were not detailed, and focused specially in studying what impact Post-Processing gives to videogames, mostly as a styling tool and its possibilities. With the conducted analysis, it was found that Post-Processing, as a videogame development tool, is very powerful and versatile, allowing it to be used both as it is intended, to give further image enhancement, as well as to help with other departments, like narrative, mechanics, design and problem solving. As a conclusion, there should be more focus and effort put into learning and teaching the theories behind Post-Processing, as well as some basics on how to enable and use it.

## Keywords:

Post Processing, videogames, stylization, photorealism, game design

## INTRODUCTION

Post processing, is, commonly known as, an area or process that has its origins in the XIX century, where, originally, done in the darkroom<sup>1</sup>, at least for the most part, and where it consisted in changing and manipulating the photographic films<sup>2</sup>, creating various effects, like, for example, create a photo with the appearance of a painting, photo bashing, color grading<sup>3</sup>, and many others. As a means of producing and image different from the original, through manipulation done after the photo was taken, that could or could not be obtained through natural ways by using other processes.

With the technologic advancement, this method evolved beyond photography and by the end of the XIX century, and the beginning of the XX century, movies started to use Post-Processing as well, initially, to produce movies with color. But again, with technology evolving, soon the digital era began, due to computers being able to deal with color images and enough processing power to edit movies and photos.

It was also in the 1950s that the first examples of videogames appeared, and by the 1970s the commercialization of videogames starts to have a certain importance in the shape of arcades, by the 1980s, the commercialization increased and since then the videogame industry continues to be even more prolific as time goes by, especially with the introduction of consoles.

By now, both photography and cinema had been using Post-Processing throughout the years, and with the increasing processing power

of both computers and consoles, videogames became even more realistic, or based in physical principles, like motion blur<sup>4</sup>, bloom<sup>5</sup> or lens flare<sup>6</sup>, and many videogame developers began introducing these effects of Post-Processing in their videogames.

## WHAT IS POST-PROCESSING IN TERMS OF VIDEOGAME DEVELOPMENT?

So when we talk about Post-Processing, in terms of either photography or cinema, we most commonly refer to the process of altering the film or original image, and editing it to either achieve a better image that the camera couldn't, or even a more artistic one, of course, this process happens always after the picture is taken, and, nowadays, is commonly done in an editing software. This editing process has therefore been known so far to be one of the steps or stages done during the Post-Production phase of a Movie, or photoshoot. The procedure used however changed when the move into computer generated images was made, for example, when creating a 3D animation, the Post-Processing is done both after the majority of the animation is finished and rendered, thus, still being part of the Post-Production phase of the movie, but some of it happens during the render<sup>7</sup> time, through passes, algorithms and filters, like anti-aliasing<sup>8</sup>.

1 A darkroom is used to process photographic film, to make prints and to carry out other associated tasks. It is a room that can be made completely dark to allow the processing of the light-sensitive photographic materials, including film and photographic paper.

2 Photographic film is a strip or sheet of transparent plastic film base coated on one side with a gelatine emulsion containing microscopically small light-sensitive silver halide crystals.

3 Color grading is the process of improving the appearance of an image for presentation in different environments on different devices.

4 Motion blur is the apparent streaking of moving objects in a photograph or a sequence of frames, such as a film or animation. It results when the image being recorded changes during the recording of a single exposure, due to rapid movement or long exposure.

5 Bloom is a computer graphics effect that reproduces an imaging artefact of real-world cameras.

6 Lens flare refers to a phenomenon wherein light is scattered or flared in a lens system, often in response to a bright light, producing an artefact within the image.



For videogames, the process is very similar to the one done for 3D animations, however, the rendering must be now done in real time, as well as any filters or effects done post-render, otherwise the gameplay framerate won't be playable, and the gameplay experience will be very poor.

This might however leave some doubts as to what a videogame's Post-Production phase like is, some saying that it happens when the game is shipped.

*"Once production is complete and the game has shipped, the game development process continues with some team members being relegated to maintenance (fixing bugs, creating patches) or creating bonus or downloadable content (DLC). Others may move onto the sequel or the next project."* (Stefyn, 2019)

Others believe that it starts in the final phase of production, during testing, and it lasts for months and sometimes even years.

Now, the need of real-time rendering means that using the filters and effects of post-processing,

must be done carefully and thoughtfully, taking into account the hardware where the game is meant to be run at, making it a specially harder study case, when the product is meant to run on PC, as it's hardware can be very different from system to system.

This is also one of the reasons that, sometimes, some filters or effects, can be switched on or off after the game is published, depending on how important it is to the videogame's narrative, visuals or mechanics, often to increase the running performance of the game in systems where the hardware isn't entirely on par with the required hardware, if the player wishes the effect to be off for his own motives, or, if the player simply wants the framerate of the game to be higher, one such example of this, is the recent addition to videogames of Ray Tracing<sup>9</sup> (**Image 1**) capabilities over the old ones like Path Tracing<sup>10</sup> ones, that, take the graphics of a videogame one significant step forward in realism, despite that, for the time being, the technology is limited to only a few certain GPU<sup>11</sup> units produced by NVIDIA<sup>12</sup> known often by RTX<sup>13</sup> (**Image 2**) GPU



Image 1 - (Zoom in) On the left we have a scene rendered using a Path-Tracing engine, on the right a Ray-Tracing engine, the biggest difference being, how the light interacts with the scene, including reflections and shadows.

7 Rendering or image synthesis is the automatic process of generating an image from a 2D or 3D model by means of computer programs.

8 In digital signal processing, spatial anti-aliasing is a technique for minimizing the distortion artefacts known as aliasing when representing a high-resolution image at a lower resolution.

9 In computer graphics, ray tracing is a rendering technique for

generating an image by tracing the path of light as pixels in an image plane and simulating the effects of its encounters with virtual objects.

10 Path tracing is a computer graphics method of rendering images of three-dimensional scenes such that the global illumination is faithful to reality. Fundamentally, the algorithm is integrating over all the illuminance arriving to a single point on the surface of an object.





Image 2 – (Zoom in) To showcase how RTX had an impact in videogames, when NVIDIA launched the RTX graphics cards, it also re-released a new version of the old Quake II21 game with a few changes to support the new technology, and in this example, where the right image has RTX enabled, one can see how much, the game visually changes.

## ITS IMPORTANCE AS A CREATIVE AND DESIGN TOOL FOR VIDEOGAME DEVELOPMENT.

So as previously mentioned, Post-Processing was initially created to get videogames graphics closer to photorealism, and nowadays they often serve the same purpose, adding effects or filters to move the graphics towards the desired result

the developers want for their game, but this doesn't mean that every developer will make their videogame photorealistic, some might opt to pursue other types of graphism, like a cinematic look (**Image 3**), or cartoon or purely faithful to the human eye.



Image 3 - (Zoom in) In this image, it is shown, from left to right, how Post-Processing can enhance the cinematic look of a scene, starting in the first image, where no Post-Processing has been applied, the second, where color grading has been done, and lastly, the third image where Post-Processing filters like bloom were enabled.

But the development put into Post-Processing since it first appearances has allowed it to be used for many other purposes, these can be as simple as using color grading to get a certain horror movie look, but it can be used to save some time during a game's development, again by using Post-Processing to, for example, make a day/night shift (**Image 4**), fix certain assets that don't have the correct color, look or tone, used to tell a story, for example, adding a motion blur filter gradually to a characters attacks, will help these to look stronger, helping the idea of levelling up, or skill mastery, and it can also be used as a videogame mechanic, for example, if the developer were

to create an horror like videogame where the character is trying to escape from an asylum with a smartphone as its primary tool of survival and it's incorporated flashlight, the developer could now opt for a diegetic interface, where the characters health was displayed in the screen by the amount of the lens dirt artefacts coloured red, representing blood splatters from when he gets injured, that land on the camera lens of the smartphone, or, as it was done in Assassin's Creed<sup>14</sup>, when the player uses the Eagle Eye ability, to distinguish enemies, from crowds and parts of the scenario that can be interacted with (**Image 5**).



Image 4 - (Zoom in) Example of a daytime scene, where, with the help of color graduation, it was changed to look as if it was night-time.



Image 5 - In Assassin's Creed games, there is an ability known as Eagle View, where the game's visuals get an under saturated look, except for the main character, objects where a player can hide, and

enemies, the first two, getting a blue (or yellow) aura with a soft bloom around, while enemies, get the same effect but with red.

It can also be used as a time saving tool, or a helping tool, as mentioned by Nally, this is because there are often a few couple of ways of achieving an end, but some might take more work and time than others, specially nowadays where game engines already have all the code put together for post-processing effects to be turned on and easily adjusted, for example, let's say that during the art phase of a videogame development, the texturing artist and the lighting artists did their work in a way that the game took place during bright morning, on a small town, if in the future the creators want to make a bigger city at night, one way of doing it would be creating new 3D models, textures and lighting. Or, instead of this, they could re-use the previous assets use for the town, and depending on how big of a city they wanted, not even need to create new ones, and use the abundance of post-processing filters to achieve the desired end. Thus, effectively saving time.

*"I've learned to try to get from A to B as fast as possible. Once a level or game is "figured out" it can always be iterated on. If you look closely at my textures or models there are lots of problems with things like seams. Post-processing effects and a proper color pallet are a great, quick way to get close to the look you want without spending a ton of time on UV'ing, sculpting and texturing." (Nally, 2018)*

This does not mean that you can just make the worst art type for your game expecting it to be fixed by simply using Post-Processing, it is not a miraculous tool that will solve every visual problem. As always using description and

therefore putting in a good amount effort into any part of the videogame development, while taking into consideration time is the proper way to go. This is also denoted by Robert Nally in his article about game making in one of his PowerPoint slides:

"Presenting your models, images, games, etc. in the best possible light is the part of the artist's job. Don't overlook post processing /finishing and presenting your work well. You could spend a ton of time on a model, but if it doesn't present well then it won't translate to the viewer" (Nally ,2018)

So, overall, it is a very versatile and powerful tool, that can help in various departments such as visuals, interfaces, design, game-player communication, troubleshooting and many others.

## THE PROBLEM

Despite being a useful tool for any videogame developer to have or learn, few videogame developers try learning or even mastering it. So far, the data collected has shown that, there are a two reasons on why this happens, one of them being because of the roles that most videogame developers want to pursue, as, in most cases, these either wish to follow the artist path, or the programmer path. The other reason is based on how, most videogame developers that are just now starting their craft, as well as those that started not too long ago, don't know about Post-Processing, or know about it almost like an instant filter that is turned on or off, similar to how many young people now use smartphone

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14 Assassin's Creed is an action-adventure stealth video game franchise created by Patrice Désilets, Jade Raymond and Corey May, developed and published by Ubisoft using the game engine Anvil and its more advanced derivatives. It depicts a centuries-old struggle, now and then, between the Assassins, who fight for

peace with free will, and the Tem-plars, who desire peace through control. The series features historical fiction, science fiction and characters, inter-twined with real-world historical events and figures. For most of the time players would control an Assassin in the past, while they also play as Desmond Miles or an Assassin Initiate in the present day, who hunt down their Templar targets.



apps, like Instagram<sup>15</sup> to edit their photos by picking filters that have been created by the app as default, instead of tweaking the photos themselves.

Going back to the first reason, it is due to, those just starting to learn how to develop videogames, either feel or think that, to do so, the only skills required is some skill in doing art and programming, sometimes, even thinking that only one of these two is required, which, depending on the grade and type of the videogame, isn't wrong. For example, a game of Tetris<sup>16</sup> would not need the most skilled 3D artist to make it. From this way of thinking, and focusing on the artist part now, there are various secondary paths that can be followed, such as 3D modelling, 2D painting, audio design, game design and many others, however there are a few others that mix both the artist and programmer path in a way, these are commonly called tech artists<sup>17</sup>, and their roles range from more art oriented roles such as rig artist to programmer oriented roles such as physics<sup>18</sup> artist. One of these roles is related to handling the Post-Processing of a videogame. But being a professional tech artist is no easy task, even if one focus itself solely on a specific role, this is also applied to the tech artists that focus their skills and expertise in managing, creating and applying Post-Processing effects and filters to a videogame, because in order to being a pro in this role, there's a certain set list or requirements needed, besides the obvious one, related to being able to program, in order to sometimes create or change a certain effect or filter, comes the required expertise in knowing many subjects and theories.

15 Instagram is an American photo and video-sharing social networking service owned by Facebook, Inc. It was created by Kevin Systrom and Mike Krieger and launched in October 2010 on iOS.

16 A tile-matching puzzle videogame originally designed and programmed by Soviet Russian software engineer, Alexey Pajitnov in 1984 for the Electronika 60 (A rack-mounted computer with no built-in display or storage devices.).

Just like in cinema and photography, knowing color theory is a very important skill set to have and know, mainly due to being able to properly apply the perfect color graduation to the film, the same is required in this videogame developer role, as well as perfectly knowing what the final image should be like, as often not knowing the smallest detail can lead the look astray or create a failed one, for example, if a videogame is meant to be a first person shooter, with the narrative being driven by the character's point of view, and one that has perfectly good eye sight and no masks or glasses, there are already a few effects that won't look well if implemented, for example, lens dirt<sup>19</sup>, since the human eye won't have these artefacts, because if any dirt were to get into the eye of a human, it is either quickly washed of by tears or it will impact the human to close its eye until it is cleaned, but if at any moment of the videogame, the character puts on a mask with an eye protecting visor, then scratches, dirt and cracks can form.

So, being it so hard to master this skillset, and with the continuing rise of indie<sup>20</sup> games and indie developers, many tech art roles aren't pursued or required, leaving this roles for bigger companies that produce AA+<sup>21</sup> videogames, and many artists or programmers, now starting their life as videogame developers know they are most likely to find a job at an indie videogame developing company close by than being accepted into a big videogame studio or company, and as such, these hone their skills towards the objective of getting their first job and keeping it as best as possible, and only a few start learning the tech art skills and theories required to follow other developing

17 In game development, a technical artist, or tech artist for short, is the bridge between level designers and program-mers working on a game. They are essentially the link between code and art. They ensure performance, consistency, and workflow.

18 Computer animation physics or game physics involves the introduction of the laws of physics into a simulation or game engine, particularly in 3D computer graphics, for the purpose of making the effects appear more realistic to the ob-server.

roles after a couple of years in a certain company, where the skillset might be necessary, the curiosity strikes the developer, or if this knows a certain bigger company is hiring a tech artist and the developer wants to follow his career towards this bigger company.

## CONCLUSION

As studied, Post-Processing is a powerful and versatile tool that should be a very desirable skillset to have and master, however, its complexity makes it a tool that is hard to master, lessening some of the interest in learning it, helped by how some have no knowledge of its existence, or, know too little about it and thus think it doesn't need too much know how. This makes it so that, the interest is even more diminished when its skillset is only recognized and valued with big videogame developing companies, and most videogame developers now starting

their career will often start their career in smaller companies seeking basic videogame developing roles, such as programmer, 3D generalist artist, audio designer and game designer. Sometimes this companies want the same person to be able to handle two or more of these basic roles, often related to the companies economy, leading many videogame developers to follow the role of a tech artist, only after a few certain points in their career, such as:

- When the company they work at required them to become one.
- When they wish to follow a better or bigger company and by chance this company is looking to hire only tech artists.
- The videogame developer, despite being at the beginning of his career, wishes to follow this path despite its hardships, which often leads him to start his career in bigger companies and projects.

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19 "Lens Dirt" is a graphics effect designed to make a realistic dirty camera lens look by making it as if the imaginary cam-era that is the player's "eyes" had dirt on them.

20 Indie is a short form of "independence" or "independent". It can refer to gaming, music, media, art, and a few others.

21 AAA (Triple A) is an informal classification used for video games produced and distributed by a mid-sized or major publisher, typically having higher development and marketing budgets. AAA is analogous to the film industry term "blockbuster". The term however has changed a bit, due to the ongoing increase in videogames popularity, thus the term also be used for slightly smaller productions, known as AA (Double A).

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# Emotional Dimension of Typographic Composition on Poster Design

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## Abstract

This paper presents an ongoing project that correlates the human emotional state with the response to different poster designs. It aims to analyze the relation of the emotional state of the viewer while contemplating the de-ployment of different types of grids, in an experimental environment.

Over time, in the fields of biology and neuroscience, emotion has been set aside as a negative influence of rational decision-making. However, studies in these fields have shown that consciousness and emotion co-exist and are inseparable. With emotion being strongly linked to decision-making power. In this scenario, it is relevant to study how emotional responses differ in graphic design, namely the effect of composition in poster design. In this pro-ject, we will use a five-channel EEG portable headset, which will monitor the real-time brainwave emotional re-sponse for later analysis and correlation.

This project has two objectives: first, to understand how emotion influences and is influenced by a visual stimulus, depending on the use of different grids and typography in poster composition; second, to provide graphic design-ers with an analysis of the emotional aspect of the perception of compositions. We expect to find a correlation that links traditionally balanced or rational compositions with calm and more focused emotional states. And asymmet-ric, or more irrational compositions with excited, or aroused emotional states. The first relation is expected to foster linear deep reading or full comprehension of the visual composition or the message within the poster. And the latter is expected to foster a faster, non-linear light reading or quick scanning of the compositions. Although there are some independent variables such as the visual literacy of the readers that might affect the outcome, we expect that the results of this research will provide an evidence-based framework to help designers and market-ers to develop more responsible user-centric designs.

## Keywords:

Poster design, typographic composition, emotion, EEG, grid

## INTRODUCTION

Emotion and awareness, as described by Don Norman (2005), relate to each other and enable human beings to ponder and make choices. In the field of design, namely web design, the user interaction with the design piece is frequently studied, but there is a gap in this study in the field of graphic design. However, the graphic designer has always been concerned about the usability of the piece, for example, in the editorial design, the concern about the choice of paper is an aspect that relates to the user's senses and that the designer has in mind. Or in poster composition the quick readability of the most important messages such as dates and places. However, there is a scarcity of studies that verify the emotional nature of the user in these fields correlating graphic design variables

### WORK OBJECTIVES

This project is born to understand how composition grids can affect the emotional state in the analysis of a graphic medium. It is also intended to provide graphic designers with an analysis of emotional behaviors to typographic composition. The user often says one thing, and feels something else (McDonagh, Denton, & Chapman, 2009, p. 1). One of the questions we will try to answer is whether this lack of understanding is due to a lack of empathy towards the visual support. This project is a pilot study that aims to employ and verify an experimental methodology designed to test this experiment.

Throughout the study, we are taking into account that the emotional state differs from the social and local context of our participants sample. So, the correlation with the users' visual literacy variable is crucial. This project will be based on the use of a non-medical grade EEG system that

will read electrical waves from brain activity. And that, in turn, these signals will be further analyzed by software that relates electrical signals to emotional states and are dependent of the manufacturer's biases.

This article is structured in two chapters, the first theoretical framework that presents a context of what is design and emotion and the main works developed in this area. The second presents the design of the experimental methodology where the characteristics of the participants are presented the tools in use, the procedures to be taken and the expected results.

## THEORETICAL FRAMEWORK

### EMOTION

Emotion, as defined by António Damásio (2004), is characterized by bioregulatory reactions aimed at promoting, directly or indirectly, types of psychological states that guarantee not only survival but regulated survival within the range that we — conscious and rational beings — identify with well-being (Damásio, 2004). That is, emotion is characterized, not by the emotional states usually referred to as joy, love, sadness, but as a psychological situation that guides us in the most primary decisions of life alongside rationality. Emotions are a crucial part of our decision making, they are what drive us, so thinking about emotion in the design is interesting because it's like trying to figure out what people want, which is often difficult.

Emotion in design is a field that has been pertinently discussed. Concern for emotion in the design process connects to sublimity and excellence in it, as it is a concern for the user experience (McDonagh et al., 2009).

A design piece with a concern for emotion,

according to Don Norman (2005), will have to cross three levels of brain processing (figure 1): visceral, that deals with the preconscious component and the initial impression, and is powerful enough to make you forget or forgive the shortcomings of the product or experience in itself; behavioral, which encompasses the component of usability, product functioning and performance; reflexive, which dwells with the meaning of the product, the impact of its significance and the cultural meaning (Norman, 2005).

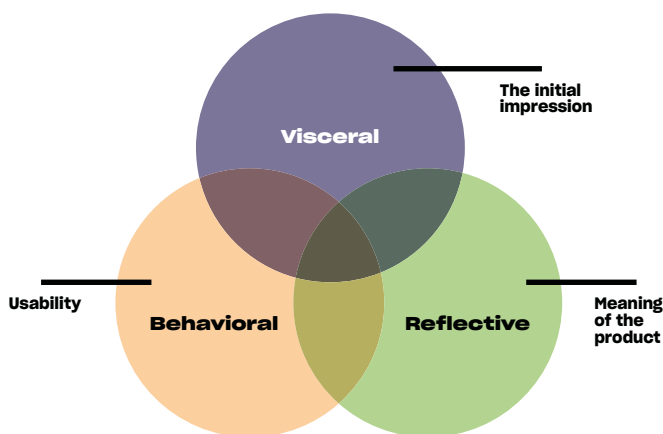


Figure 1 – The three levels of brain processing for a design piece with concern for emotion, according to Don Norman in the book *Emotional Design* (2005).

## EEG

Electroencephalography is a technique for measuring and recording brain activity through the use of sensors placed along the user's scalp (Niedermeyer & Silva, 2005). The collected EEG signals are scanned and then sent to a mobile device or computer for data storage and processing. The EEG system often used in research as the process is non-invasive to the object of study can detect changes in millisecond order, which allows to precisely synchronize what happens in the brain and the environment.

## VISUAL LITERACY

In Antonio Damásio's theory (2009) it is described that when making decisions the human brain tries to anticipate what that decision will be, and whether it will make us feel positive or negative emotions, based on our memories and past experiences (Damasio, 2009). Therefore, we can see that when we look at a graphic design composition, it can instill in us a certain feeling that is brought about by memory and sensory experiences. And in turn, that correlates with the readers' visual literacy.

Visual literacy, according to John Debes in 1969 (cited by the International Visual Literacy Association), is characterized as a group of visual skills that a human being can develop through sight and other sensory experiences. Through the acquisition of these skills, the human being can discriminate and interpret visual actions, objects, and symbols, natural or artificial that they find in the environment.

With training and practice, one can develop the ability to recognize, decipher, and employ the syntax and meaning of the different visual forms. The process of becoming more visual literate continues throughout human life, learning new and more sophisticated ways to produce, analyze and use images (Felten, 2008).

Jean Trumbo presents a theory in which visual literacy is divided into three dimensions: (1) visual learning that deals with the process of gaining awareness of the meaning of visual stimuli and the method an individual uses to interpret meaning from visual representation (Trumbo, 1999, p. 415); (2) visual communication is defined as an optical stimulus, which is intended by the receiver. The goal of visual communication is to produce strong images that allow the viewer to perceive and remember its content. Each form of representation carries with it its conventions and potential for interpretation (Trumbo, 1999, p.

418); (3) visual thinking implies the incorporation of images into conscious and preconscious thinking as it affects the human process of organizing mental images using shapes, lines, colors and compositions that enable the creation of meaning (Trumbo, 1999, p. 412). These dimensions will be used as a pattern of evaluation on visual literacy assessment. The evaluation parameters will be those in the table defined by Jean Trumbo about the dimension of Visual Thinking (figure 2).

Visual Thinking Dimension
<b>Metacognition</b> Awareness of the process of visual thinking Thinking about visual images or representation Visual thinking as a substitute for real-world action
<b>Creative and critical thought</b> Pattern recognition and elaboration Intuitive thinking; Flexibility and the fluency of ideas Innovation and an ability to arrive unique solutions Analytical thinking and reasoning
<b>Visual thinking process</b> Role of the eye and brain in the process of vision The nature of consciousness and thought Awareness of visual form and composition Ability to interpret visual representation A systematic approach to the evaluation of visual representation
<b>Visual thinking skills</b> Perceptual skill Mental imaging skill Aesthetic sense
<b>Content knowledge and visual thinking</b> Knowledge of the scientific principles being represented Knowledge of the symbols and the notation used within the discipline Knowledge of the conventions of visual representation used within the discipline

Figure 2 - Jean Trumbo's table of the visual thinking dimension.

The way we analyze the images and how they come to us hangs in our mind creating representations that can be linked to a precise moment, in which we remember the place where we saw the finished poster, for example, how we can only have the image awareness but not knowing where we saw it because it did not arouse our focus.

## GRID

The process of analyzing an image, as we have seen, is influenced by the degree of visual literacy that the people under study have. The use of a composition grid on a poster or any graphic object introduces order into a layout and allows

for differentiation of information types, making it easier for users to navigate and certifying elemental cohesion through proportion systems (Samara, 2017).

The grid allows a hierarchy of information, with title, subtitles, subtitles, and the size will always be larger in importance (Müller-Brockmann, 1997). Consistent margins and columns create an underlying structure that unifies the pages of a document and makes the layout process more efficient (Lupton & Phillips, 2015).

Throughout history, new forms of grid systems have emerged allowing the designer to organize a space that is three-dimensional as an exhibition or two-dimensional as a poster (Müller-Brockmann, 1997). Timothy Samara divides and unifies grid systems into 5 different sections by page structure criteria.

The first is based on the manuscript grid of the medieval era that is the simplest in structure because it consists of one large block of text. The purpose of this type of grid is to concentrate a large volume of text (Samara, 2017). This type of grid is usually used in more formal cases because it brings a historical panorama that brings us back to the institutional one. This type of grid system lacks the power of creativity, yet it is still a universally safe alternative to working text. Second, the column grid provides flexibility by providing the option of using different columns for the same or differentiated information (Samara, 2017).

For complex projects involving different types of information, the third, the modular grid may present a viable solution (Samara, 2017). As defined by Timothy Samara, a modular grid is characterized by a column grid with a large number of horizontal rows that subdivide the columns into rows, creating a sort of table where cells are called modules with each module defining a small group of information. Fourth, the hierarchical grid is organized intuitively by the designer to hierarchically

organize the information as needed. The width of the columns, as well as the interval between them, vary depending on the context of their use (Samara, 2017).

And the fifth, the compound grid refers to the use cases of multiple grid systems in the same project, both between different sections of a book, for example, and in a single poster. Each grid can be intended for particular content. These types of grids were born on books although they were transferred to the poster design. So, in this study, we will put into practice this type of grids as their variants with the changing of alignment, leading and position.

## EXPERIMENTAL DESIGN

### METHODOLOGY

This experiment is prepared with two phases: (1) characterization of participants in their literacy; and (2) the observation of posters. In the first phase, participants will be filtered and characterized through a questionnaire at the beginning of the session. The visual literacy questionnaire will be designed according to the work on the three visual literacy dimensions of Jean Trumbo, in which one is visual thinking. Within this parameter we will invite the participant to discuss topics crucial for the image analysis, such as critical and creative thinking, knowledge of symbols & semiotic meanings and knowledge of conventions. To promote this discussion, we will present a series of posters of various artistic movements and place multiple choice questions for them to answer. Along with questions about posters of various artistic movements, in the visual literacy questionnaire, questions will be asked about visits to cultural events, the last books read, the last films and theater play, as well as the frequency with which they do this type of activity. This assessment will be qualitative and there will be three levels

of classification, low, medium, high. We note that this test is aimed at the assessment of visual literacy in the field of graphic design, so it is not an assessment that can be replicated in another situation than this; In the second phase, we will present the user with an observation session of posters on screen, with different typographic compositions in which the participant merely has to observe what is placed on the screen, monitored with EEG and observed by the researchers while following a think-aloud protocol.

In total will present 60 posters with different typographic compositions in which will vary each variable related to the grid composition: leading (typography), position, alignment. Posters will always have the same colors or tonal patterns, and the format size and font will not change either. Each of the poster slides will last 8 seconds, so that there is no time to read information and only the reading of the most immediate message and perception of the general composition can be done. The order of how the posters will appear will be randomly controlled. From one poster to another, a brief relaxation pause is displayed through a neutral gray image. At this time binary questions will be asked about the poster. The set of posters will be displayed on a 40-inch monitor at a calculated distance of 150 cm from the participant.

### PARTICIPANTS

It is estimated that this pilot experiment will be conducted with 25 participants with normal or corrected vision. There will be 10 graphic design students, 5 teachers from the same area, 10 students from non-visual fields, in a total of 25 participants. Participants are chosen probabilistically, for convenience, for distinct competencies so that we can make a broader analysis of emotional study dependent on visual literacy.

## PROCEDURE

The experimental procedure is organized in 9 steps (figure 3): (1) Invitation by email, voluntary response or participation; (2) Scheduling of the session and pre-filter. Each participant will be assigned a letter to ensure his or her anonymity; (3) Participant's installation in a controlled environment; (4) Explanation of evaluation design and establishment of an emotional baseline – a questionnaire will be employed to determine the participant's emotional stability; (5) Delivery and completion of the visual literacy test; (6)

Assembly of the EEG (Emotiv Insight) system and verification of the signal quality detected in the analysis program used; (7) Calibration to record each participant's signal baseline; (8) Randomly displaying a set of posters and recording measurements, observation. Collection of the participant's opinion; (9) Final interview, ask to assess each one's reported experience.

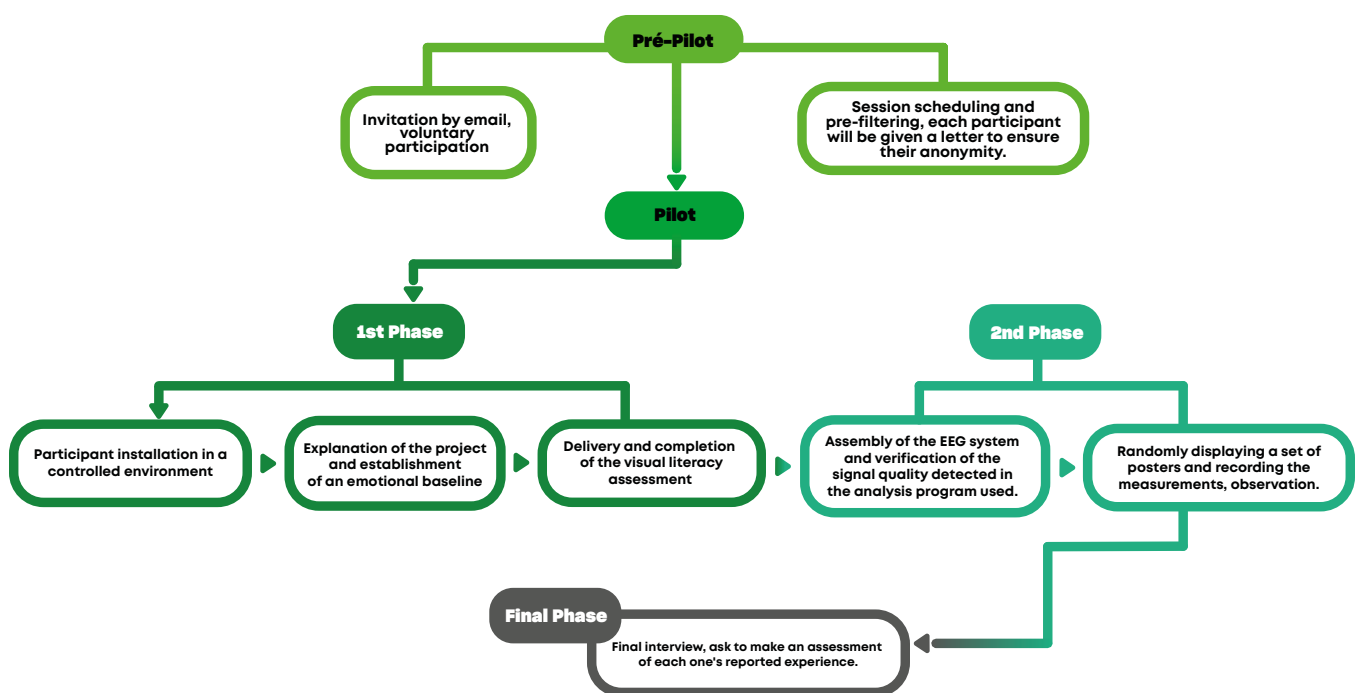


Figure 3 - Procedure Diagram

## TECHNICAL EQUIPMENT

The Emotiv Insight portable headset EEG will record brain activity. This model is developed by Emotiv and has 5 EEG sensors and wireless connection via Bluetooth. The recording of the signals will be done on a laptop, or a mobile using the provided API with a custom software and the data will later be exported into a spreadsheet format for statistical analysis. The preparation time with this Emotiv model is around 2 minutes. The Emotiv Insight API provides the interpretation of the raw signals as three types of stimulus: (1) mental com-mands; (2) facial expressions; (3) performance metrics. For this project, we will evaluate performance metrics such as stress, focus, arousal, excitement, engagement, interest. The measured metrics, although not in the conventional emotional states – e. g. love or sadness — are emotional responses that make it possible to infer positive or negative user states.

## DATA ANALYSIS

Data analysis will be done by employing a nonparametric correlation test of the independent variables to the dependent variable that is reported or measured emotion.

## EXPECTED RESULTS

It is expected that in tests where the grid is radically varied there will be a negative emotional response, an increase in stress and a decrease in interest from people with low visual literacy, because there is greater empathy with the traditional grid pattern as block grid. However, greater acceptance of the depersonalization of the standard grid concept is expected in people with greater visual literacy, with increased values for engagement, focus, and excitement. These results are expected because

the greater the visual literacy the greater the power to relate a poster with a given grid system to historical movements that already have it working.

The study developed in this project aims to provide a guide or a conceptual framework of emotional behaviors, according to its potential implication to typographic composition, depending on visual literacy to the target audience. It can serve as a tool for designers who aim to explore the potential of the general rules of typographic composition, as well as promoting a methodology that aims to study the emotional states in typographic composition in the poster.



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# Play to Design: A Case Study for a Playful Game Design Methodology

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## Abstract

This paper introduces a playful and imaginative approach to game design, in which the designer first plays in order to only then design, and presents a case study where we explored such methodology that combines two design tools: i) Cards Go, a card-based game, of our authorship, that combines unexpectedness, chance and randomness to create the conditions for creativity and imagination to have a chance to emerge; and ii) MEX, a framework that provides a conceptual structure to analyze and design user experiences by considering a set of interrelated elements (Context, Activities, Momentum, Individuals, Artifacts, and Interaction) that represents a factor of influence in the overall experience. This method uses Cards Go for concept creation and MEX for refinement and documentation. In order to examine the applicability of such methodology, we conducted a 4-hour game design workshop with four participants (men = 2, women = 2), from distinct fields [n = 2 informatics, n = 1 design, n = 1 multimedia]. The workshop was divided into four stages. During the first stage, we presented a brief introduction to game design, only enough for participants to get acquainted with the discipline and to have a basic starting point. In the second stage, participants were divided into 2 groups of 2 people. Cards GO was introduced and participants played 2 rounds, with the aim of creating 1 game concept per round. At the end of each round, we promoted a feedback discussion on the results obtained. We introduced the MEX framework at the third stage. After that, the teams were invited to develop one of the game concepts created during the previous stage using the MEX framework and taking into account the feedback provided by their colleagues. At the end, the participants were invited to answer a questionnaire following the Intrinsic Motivation Inventory (IMI). After the workshop, the outcomes were reviewed by three game

design specialists aiming to observe aspects such as creativity and viability of the games created. Overall, we can state that this methodology is an efficient means for game design, and useful as well for the development of creative thinking. Participants declared that the workshop's activities were not only fun and playful, but they also described them as very interesting. They also stated having experienced a low level of pressure and tension during the workshop, factors that are considered to be negative predictors for intrinsic motivation. Moreover, self-reported results also indicated that the presented techniques can improve collaboration and creativity.

### Keywords

**Game Design, Creative thinking, User experience, Methodology, Playful design**

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# Track

## Design for New Materials and New Manufacturing Technologies

*Materials have always played a key role in the design process. Through them designers were able to express themselves and give shape, function and meaning to design ideas. If, at one time, materials and technologies were reasonably well known and stable, today, both worlds are characterized by dynamism and fast evolution. Nothing can be taken for granted anymore, and almost everything seems possible. Both yesterday and today, however, materials emerge as cultural expression and details that characterize a society – and therefore any reflection upon them cannot be set apart from a wider (social and cultural) framing. The track “Design for new materials and new manufacturing technology” aims to illuminate the role of materials in the present as well for the nearby future. Focus will be set on a broader scope the planetary social changes highlighting the relation between local and global in the design context. The track would like to explore, but is not limited to, the following topics: (i) materials and technologies for social changes; (ii) local materials and technologies; (iii) alternative sources for future materials; (iv) tools for materials selection; (v) challenges in the design of materials identity.*

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# Material as storyteller. Hybrid ways between the local heritage and the global perspective

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## Abstract

The debate around the loss of regional specificity as the consequence of globalization has accompanied the overcoming of modernity and gave birth to a new discussion around the relationship between places, history, products and identities. The design culture is questioning around the theme by applying new models of production and design closer to the local dimension that can embody an enhancement strategy for territorial specificities, identified in the use of local resources and material cultures, like knowledge, symbols and techniques.

In Setting up a dialogue between local identities and contemporary issues, design became a tool for transmitting material and immaterial heritage that, through the contamination and hybridization of methods, techniques and resources, can produce artifacts able to remember the past, the history of places and people, but even to narrate their own story, from their production to their use. In this scenario Materials act as an interface narrating several aspects related to territorial specificity in which is clearly visible the value of signs as the result of the direct action of man and nature on matter.

The paper will show how it is possible to create, through design, innovative scenarios, by establishing new dialogues: between two ways of production currently considered distinct: the standardized one of globalization and the withdrawn one of the local districts; and between user and products through new ways of interaction between materials and environment, production process, and way of use.

## Keywords:

**Local Identity, Material interactions, Human Traces.**

## 1. AFFORDABILITY VS LOCAL SPECIFICITIES

During the last century the introduction of bulk production has fueled the accumulating principle of capital producing and, whilst it has guaranteed the access to goods till then considered a luxury, it produced semantic and environmental pollution (Manzini, 1990) from a large scale of objects with questionable material and immaterial value. The serial nature of machines has interrupted a chain of uniqueness and diversity of knowledge creating products and morphologies without any geographical connotation or territorial culture claim. The belonging of objects to places, that characterised the material culture from the first signs of the human presence on earth, has gradually disappeared together with the progress of industrial society, with the substitution of manual skills linked to handed down techniques and to the expertise in making. The objects therefore represent the dimension that has paid the highest price of entry to modernity. The postmodern condition so became, above all, an attitude in facing the loss of identity suffered by modern society with the born of the necessity to recover the notion of regional specificity and to create a new discussion around the relationship between places, history, products and identities (Burkhardt, 1997). The open challenge of contemporary is to bring together the cultural diversity of places with the elements of a widespread global culture, and let coexist and interact universal object with local systems without the former prevailing over the latter. Preserving places means designing a world in which curiosity and a desire for knowledge oppose the homologation that the incorrect use of technology entails. The System of objects plays a primary role, especially in Italy, in which materials, craftsmanship and knowledge of the territories have been the basis of economic

development and of a global national identity.

## 2. THE ANSWER OF DESIGN: SELF-PRODUCTION AND MATERIAL EXPERIMENTATION

Design culture is questioning around the theme of locality-globality by applying new design approaches and models of production closer to the local dimension of self-production, based on the figure of designer-entrepreneur. Starting from the third industrial revolution, new opportunities concerning the way we produce or distribute products and services appeared to be possible, thanks to digital fabrication technologies that allowed miniaturization, networking, integration and interconnection of production and distribution processes (The Economist, 2012). So, with democratization of technologies, designers moved into the FabLabs contaminating and often blending with the Maker culture, triggering new self-production and co-design approaches which mirror the increased consciousness about social, cultural and environmental impact of industrial mass production. In a world where everybody designs, designers are now charged with a new responsibility upon products; self-production is indeed a political word (Maffei, 2013), in the way that it potentially unfolds a new path for the development and evolution of design culture. It characterizes and describes a twist between business and design, acting within territories contributing to their socio-cultural and economic development. The focus of designers is then moving from products to processes, with the emergence of



new approaches bringing about a radical shift in the design culture, placing materials as starting point of the project and input of the creative process, operating a transition from the mere selection from a pre-existing palette, to direct involvement in material experimentation. Manzini first highlighted how materials don't represent anymore given entities upstream of the project becoming in their turn elements to be designed, and so innovation can arise both from the quality of the idea as from the intrinsic qualities of the material itself (Manzini, 1986). Material experimentation represents also a way for learning about materials and research their *hidden character* (Ashby, 2014), vehicle of immaterial and sensory aspects; it is able to produce unexpected results and let designers develop a novel and different position compared to their initial ideas and mindset (Farresin & Trimarchi, 2019). Such design approach brings *iperdesign* in the field of matter (Lucibello, 2018; Lucibello & Ferrara, 2009), places designers into laboratories – new places for making –, and identifies in the *neomateric* phenomenon (La Rocca, 2016) – intended as the reconsideration of the fascination and the potential inherent to direct transformation and processing of matter – the evolutionary push of the project. Material experimentations create then new relationships among designers, processes, techniques and materials (Rognoli et al., 2015), giving rise to unique and unconventional design experiences which often result in outputs related to territory and local culture, and expanding the designer's conception of what can be self-produced to almost everything. Understanding production processes can suggest new rules and bring designers to follow unexpected paths. Starting from the interaction with materials, studying their characteristics at various scales through tinkering and self-production, is in fact a source of inspiration for the project, able to generate invention and re-think the paradigms of

the material culture (Trebbs, 2018). Experimenting with materials and production processes can embody an enhancement strategy for territorial specificities, setting up a dialogue between local identities – which represent both local resources and material cultures, like knowledge, symbols and techniques (Follesa, 2013) – and contemporary issues such as environment, technology innovation, production processes and society needs, in a dynamic process of endless contamination between the local and global dimension.

### 3. DESIGN STRATEGY: AN EVOLUTION OF IDENTITY

Contamination represents a stimulus to the evolution of identities: every culture lives in the deal between identity and otherness, between local knowledge and external knowledge. We must not protect and isolate cultures but renew them and develop new identities by drawing on local cultures, made of signs, symbols, techniques, textures and morphologies and combining them with contemporary issues, languages and needs. This approach will be able to create connection between the local and the global dimension, verifying the ability of local products to enter the large flows of the economy through their own peculiarities applying the principle of *produce locally, think globally*.

Design will be able to establish an interaction between technology innovation and craftsmanship, solving some problematic aspects of artisanal production through the use of digital technology and rapid manufacturing processes, simplifying the processes but preserving the authenticity of handicrafts, their unicity, their suggestions and their connection with territories. Finally the design strategy will set up a dialogue between the elements of ancient tradition and the contests of contemporary made of different

spaces, uses, habits and values.

Examples of this kind of hybridization show how it is possible to create new languages from the combination of traditional materials and rapid manufacturing processes, not simply entrusting to machines the reproduction of ancient textures and typologies, but exploiting their potential to re-elaborate them. Alternatively, using traditional process and methods on new typology of materials – result of contemporary needs – to award them familiar aesthetics. The results of this process should be Artifacts that embody the memory of traditions together with the concretization of the current evolutionary processes (Lotti, 2010), Designer so draws on territory resources but re-elaborates them, combining them, renewing them, repurposing them in new forms, designing through materials (Lucibello, 2018) preserving their symbolic values. With this approach design becomes a tool for transmitting material and immaterial heritage turning intangible values into meaningful objects (Lerma et al., 2018).

## 4. MATERIALS AND NARRATIONS

Materials become storytellers, able to narrate ancient traditions, but even their own story, from production to use, expanding the concept of both collective and individual memory, and enhancing the emotional involvement of the user. They indeed “stimulate an emotional tension with our historical memory: a condition that designer sublimates into product in any project” and “interacted over time with the production processes – from the artisan’s work to the manufacturing techniques – modelling and modifying them to adapt them continuously to their own prerogatives” (Paris, 2009). In this way they act as an interface (Parisi & Rognoli, 2016). narrating the evolution of our relationship with them, as well as several aspects that can

reconnect products to the territory they belong.

### 4.1 TRACES OF GEOGRAPHY

An inescapable relationship so links technique to matter and matter to territory, understood both as geographically determined location – offering raw material as a resource to be used – and as sense of belonging to a community (Fiorani, 2000).

An example in this regard is *De Natura Fossilium* project by Studio Formafantasma, which investigates the culture surrounding the Sicilian Etna’s experience to bring both the landscape and the forces of nature together as facilities for production. With this project they investigate the link between tradition and local culture and the relationship between objects and the idea of cultural heritage: the Etna landscape and its raw materials are no longer object of mere contemplation but become, through manufacturing processes, living and vibrant matter.

Materials can also show us how the climate and morphology can change the fruits of land, as in the case of the *Sensorial Kit for Craft Beer Tasting* by Chiara del Gesso, realized using Brewery Spent Grains or BSG as raw material for the production of a set of tools for tasting solid craft beer.

According to the place or region where the kit is realized, the grain presents different textures and colours, which are transferred to the material and so embedded in the final product.

*Algae Geographies* is a project by the Algae Lab of Atelier Luma (see Fig. 1), a center for experimental cultivation who explores the potential of production of bio-materials from micro and macro algae. The increases in temperature together with the acidifications of waters are threatening many marine species, creating on the other side a favorable environment for algae growth. Aim of this project is to employ locally sourced algae in the bio-materials production, developing

moreover a material library concerning algae and other living materials, available to designers. Their ambition is to map a network of resources, competences, and cultural documents in the Mediterranean area, working together with native communities in order to reactivate local economies.



Fig.1 “Algae Lab” by Atelier Luma. 3d Printed pots realized with filament derived from algae of different geographic areas. [Antonelli, P. & Tannir, A. (2019). Broken Nature. XXII Triennale di Milano. Electa: Milano].

#### 4.2 TRACES OF PRODUCTION

Materials can narrate the belonging of products to places also through traces of manufacturing and production techniques. Unique and special production processes have been historically connected with specific places, a condition that now has been lost with the progress of industrial society. Nowadays however, new types of signs mark the products: this signs are no longer those of manual craft production, but instead are signs of tools and machines used, or signs of the laboratory or atelier environment, displaying in both cases signs of the production in a specific place or location.

In the case of *Adaptive Manufacturing*, a collaborative project by Sander Wassink and Olivier van Herpt (see Fig. 2), the starting

point and core of the concept is to highlight the production process at a time when digital technologies have replaced the craftsman, removing all the traces of human and local influence. Their research looks at the possibility of sensing the local environment and embed it into the production process, translating it into specific behaviours of the printer through software: the printer becomes a sensory machine that feels its environment, translating input into a document of a specific time, location or raw material.



Fig.2 “Adaptive Manufacturing” by Oliver van Herpt & Sander Wassink. Printed Terracotta. [Antonelli, P. & Tannir, A. (2019). Broken Nature. XXII Triennale di Milano. Electa: Milano].

From a twist of tradition and innovation, *Terra Cotta* project by the Iranian designer Talia Mukmel (see Fig. 3) explores materials and sign of ancient times mixed together with contemporary processing methods. The designer was inspired by communities in desert climates, which make use of available raw materials to produce everyday objects. The result is a series of unique containers made of sand and flour, realized using threads to create the final morphology while the artefact is baked in the oven. As an evolution of the product in a second stage she used the modern technology of photo etching to create a metal grid, so printed circuits and etching are mixed

together to create a new surface on the material. Finally, with her project *Made By Rain*, Aliko van der Kruijs (see Fig. 4) developed her own technique called pluviagraphy to capture raindrops in ink, in order to create textures and color variations impressing rain on fabrics. Through this process she realized a collection of unique textiles, each customised with specific time, location and amount of rainfall, making it possible to “wear the weather”.



Fig.3 “Terra Cotta #1” by Talia Mukmel. A first version of the project realized with ropes that in the later stages will be substituted with metal grids. [Antonelli, P. & Tannir, A. (2019). *Broken Nature*. XXII Triennale di Milano. Electa: Milano].



Fig.4 “Made by Rain” by Aliko van der Kruijs. [Lipps, A., Condell, C., McQuaid, M. & Bertrand, G. (2019). *Nature: Collaborations in Design*. New York: Cooper-Hewitt Museum]

#### 4.3 TRACES OF USE

Tools and technologies “mark” materials in a vivid and peculiar manner modifying products’ morphology and determining the gestures around production and use affecting our lifestyle. At the same time people interact with products through materials – interfaces in such interaction – leaving signs and traces as a testimony of their interplay. Such traces can narrate about individuality, returning signs of the use by a single person as in the case of *Infected* by Maurizio Montalti (see Fig. 5). The project consists of a series of 3D-printed jewellery pieces inspired by an experiment with fungi, which got contaminated by the accidental human touch. As a consequence different kinds of bacteria started growing on the product’s surface, creating new textures and shapes, and narrating about the fundamental role that such micro-organisms play in our everyday life. Aim of the project is indeed pushing to reflect on our body’s identity and the variety of life-forms which co-exists with us.

Moreover the traces can narrate about the behavior of an entire community, like in the case of Odo Fioravanti’s *Verderame* or Adrianus Kundert’s *Ripening Rugs*, copper tiles in the first case and a textile rug in the second, both changing their colour according to the consumption caused by people walking on them over time. Within this projects the process of wear is turned into a positive and narrative element, gradually revealing paths and signs of movement, as well as textures, colours and patterns through erosion, making the material somehow alive.



Fig.5 "Infected" by Maurizio Montalti for Officina Corpuscoli. Ring model customized after the interaction of human bacteria and mycelium. [Retrieved from <https://www.corpuscoli.com/projects/infected/>]

opposing to the homologation process and conferring back an individual and collective narration to artifacts.

## 5. NEW INTERACTIONS FOR THE IDENTITIES' EVOLUTION

The approach described in the contribution allows to trigger a process of objects identities renewal, not only through several design thinking but through the products belonging to a cultural heritage related both to geographic territories and to the community made up of individuals sharing places, activities and knowledge. It is crucial to preserve this kind of heritage by embracing the economical and technological changes of contemporary society, considering them as an opportunity rather than an obstacle. In this scenario the figure of the designer changes his role; he is no longer bound and involved to the mere designing principles and processes, but he manages even relations and consequences proper to the discipline. The materials, acting as a filter between user and products and relating to the sensory perception sphere that is responsible of the emotional involvement, still reveal themselves as a vehicle of meanings and lead us into new ways of interaction with objects that will customize the individual user experiences,



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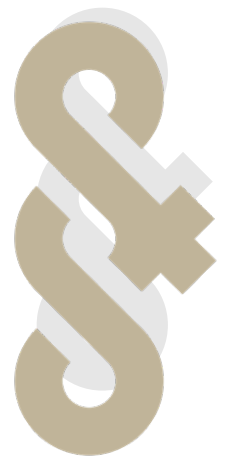
# The potential of flexible wooden structures in a project of furniture design.

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## Abstract

Due to the population growth in cities, houses and apartments tend to be smaller. In this reality, comes the need to invest in multifunctional furniture for more versatile rooms. To respond to this problem, new design trends and systems that allow people to live comfortably in a small space have emerged, as it can be seen from the development of multifunctional and retractable furniture. Therefore, for the past years, there was a development of several manufacturing processes that can make wood flexible. Even though its use is limited mostly to coatings and partitions, these developments of flexible wooden structures is making its way to exploring its potential and new applications. This paper intends to take further the potential of these structures by combining wood flexibility with furniture design projects. A search was conducted about methods and technology that allows rigid materials to be flexed and it was decided to use the method created by Dukta, a swiss company that uses specific cut patterns in the wood to make it flexible while maintaining its mechanical properties. This paper describes and discusses a project created by us named WoodFlex within the framework above mentioned, stressing the argument that design and technology influence each other.

## Keywords:

**Product design; furniture; wood; technology; flexible structures**

## 1. INTRODUCTION

### Design and Technology Evolution

Design is associated with the evolution of manufacturing technologies, after all, the designer of a product has to take into account the manufacturing methods to be used and therefore, their limits. With the evolution of the manufacturing techniques, especially after the emergence of digital manufacturing, processes become increasingly varied and automatic, giving designers greater creative freedom. Thus, the designer must always be aware of new technologies both in terms of manufacture and the material itself, also collaborating with the development of new techniques to apply them in the process of innovation and creation of new products.

The relation between design and technology became stronger in the industrial revolution in the 18th and 19th centuries, as product manufacturing methods underwent a drastic change. The introduction of machine tools into manufacturing processes has made mass production standardized in contrast to hand-made products one by one. Due to this fact, the design sector had to adapt to design products to be manufactured on a large scale, thinking not only about functionality and user, but also about their method of manufacture, using the emerging technologies to their advantage, all without affecting their durability and costs.

Consumer needs and demands change over time, stimulating the evolution of technology and design to meet their needs, so there is a mutual influence on the evolution of these two areas, as design accompanies emerging technologies, there are also new technologies that are developed to meet the design needs and, consequently, of the consumer. By analyzing a simple object such as the chair, the influence of new technologies of the time on its creation is clear, both through the use

of the material and its manufacturing process, as illustrated in Fig. 1 (Chang, K., & King, S., 2016).



Fig. 1. Various models of chairs in different materials ©Ana Costa's composition

These are some of the many examples that illustrate the relationship that exists in the evolution of design with technology, where we can see the impact that technological advances have had on chair design. Outside of manufacturing technologies, virtual reality and simulations have also been used in a variety of areas and are increasingly important today, such as in engineering and product or interior design, where it is possible to test the product without having to put the project into practice. Programs and tools have also been created that allow the designer to perform tasks that were previously not possible to improve and assist the processes of product creation and development.

In such a saturated market, there is a constant demand for innovative solutions. The union between technology and design allows the creation of differentiating products, because the designer can use the characteristics of production technologies to his advantage. Techniques such as laser cutting, 3D printing, machining, etc. have been around for some time and their applications are vast. Recently, however, there have been ways of making certain rigid materials flexible by changing their geometry or composition. This

brings innovation, versatility and creativity to the market and takes advantage of the potential of these techniques.

## 2. FLEXIBLE STRUCTURES

Flexible structures have appeared in various types of materials and for various purposes. With the creation of composites, where the goal is to derive the best properties from each material, various materials were produced that combine rigidity with flexibility. We can see this combination in some products such as stone carpets designed by Dominik Raskin, represented in Fig. 2. It combines a very hard material, stone, with fiberglass, using a very thin layer of stone with this fiber on a cotton base making the material strong and durable, and it can at the same time be folded with very interesting geometric effects (Neira, 2015).



Fig. 2. Stone Rug - Dominik Raskin ©(site Neira, 2015)

There are also projects where they have combined wood with polymers to create a flexible surface, such as the JC Karich's Rombo Chair shown in Fig. 3 where he uses polymer-bonded plywood, which makes the seat and back of the chair adaptable to the shape of the user, this chair has the characteristic of not requiring nails or screws. Another example of this technique is the Flexible Holz Chair also presented in Fig. 3, created by two students at the University of Berlin, who applied a wooden silicone surface to the seat and back of the seat, making them flexible (Karich, J., 2013; Antonelli, 2012).

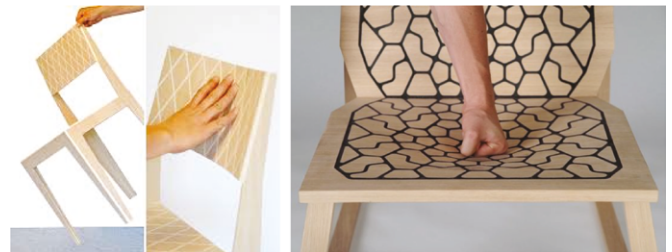


Fig. 3. Rombo Chair - J.C. Karich ©<http://bit.do/fcwL5> and Flexible Holz Chair ©(site Antonelli, 2012)

BMW has also created something very interesting in this area, with the prototype BMW GINA (Geometry and Functions In "N" Adaptations) where they push the limits of car design. An outer layer is incorporated into the model, created from a flexible textile covering that extends into its movable inner structure as shown in Fig. 4. This provides different capabilities as it allows to do things that rigid structures can't, like moving and adapting to new forms, in addition to being lighter, it's made of materials that require less energy to produce than metals (Designworks, 2008).



Fig. 4. BMW GINA ©(site Designworks, 2008)

These are some examples of how these types of structures have been emerging, whether by seeking a differentiating design or looking for lighter solutions. Technology is always evolving, and design and engineering need to accompany and empower this process. There are several ways to give rigid material flexibility. In addition to creating composites that combine rigid materials with flexible materials, you can also change the geometry of a material to give it flexibility. Within this idea, a material can take shape through additive or subtractive processes. Additive processes, such as 3D printing, are characterized by constructing the product by depositing the material in successive layers, in which case it is possible to create a flexible product by controlling the way the material is deposited, creating patterns that form a rigid product but allow it to deform. Subtractive processes, on the other hand, are characterized by the removal of material from an initial block, such as CNC machining. Within these are some processes that are used to make a material more flexible, namely cutting, laser cutting or roughing. In these cases, unlike 3D printing, the initial shape of the block is not controlled but rather its

final shape and can create patterns or weaken certain parts of the material so that it can bend. In addition to metal and plastic materials, wood can also be used in these processes (Ramos, A. M., Relvas, C., Simões, J. A., & Mota, L. M., 2017).

## 2.1 FLEXIBLE STRUCTURES' PROJECTUAL CASES

In order to better understand flexible structures and their techniques, design cases have been studied where it is possible to verify the use of various techniques to impart flexibility to rigid materials such as wood and PLA or ABS. For example, Dukta is a company located in Switzerland, founded in 2011, dedicated to the production of flexible wood. It uses specific cutting patterns to give the material flexibility, there are several types of patterns that give different levels of flexibility to the product. The process was created and patented by Dukta. Machining cuts are mostly applied to solid wood, MDF and plywood. The company has six types of patterns represented in Fig.5:

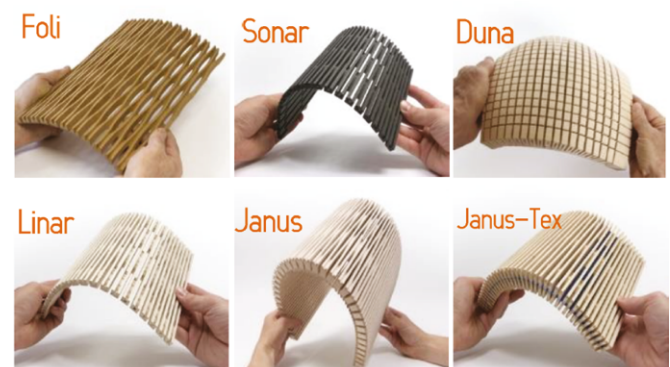


Fig. 5. Dukta's cut patterns ©Ana Costa's composition

Dukta's products are mainly used in partitions, panels, coatings and acoustic systems, giving new life to spaces. The incisions alter the structure of the panels, the parts opposite the incisions are flexible, but the material maintains stability along the direction of the cuts. The types of cuts are varied and therefore differ in appearance, offering



the user a wide range of design choices for use in various types of environments. (Learnvest, G., n.d.). Also WoodSkin and Aaron Porterfield's Project are examples of flexibility applied to wood. WoodSkin is a company located in Milan that started in 2013. Like Duk-ta, Wood-Skin is also dedicated to the production of flexible wood using a different method. It has the characteristic of being able to give a textile like property to wood by creating a composite. It uses the wood cut in triangular pieces to form two layers, with an intermediate vinyl layer, producing a kind of sandwich with both materials. This technique combines the rigidity of wood with textile flexibility and allows the development of complex structures and geometries that would not be possible to be made of wood alone, as shown in Fig. 6. This product is applied to panels, cladding, art pieces, and on some furniture (Dukta, n.d.).



Fig. 6. WoodSkin panel ©<https://www.archipanic.com/woodskin/>

Aaron Porterfield is an American industrial designer founder of FequalsF. He experiments with laser cutting on acrylic and wood. Like Dukta, he uses several cut patterns for different results. Porterfield performed his experiments by first creating the patterns himself in programs such as Adobe Photoshop and Adobe Illustrator and then using a laser cutting machine to make the incisions in the material. Fig. 7 presents the results of experiments performed by Porterfield

(Wood-skin, n.d.).



Fig. 7. Porterfield experiments results ©Porterfield

### 3. THE PURPOSE OF PROJECT WOODFLEX

#### 3.1 PROBLEM ANALYSIS

Wood is a material with many environmental benefits as it is a natural and renewable material. Therefore, its use is ideal for furniture due to its mechanical and aesthetic properties. The appearance of flexible wood has increased its potential in this field, as various types of wood can be used, namely MDF, which has ideal properties for this context. In a society where housing space is shrinking, and the population is growing and moving more and more to cities for a better quality of life, houses and apartments tend to be smaller. According to Gabrielle Learvest of The Muse magazine, the reasons for this increase in micro apartments are due not only to the increase in population in the cities, but also to the inability of part of the population to rent/

buy larger spaces due to the price increase, as they are only accessible on the suburbs of cities (Porterfield, A., 2016). People are choosing location over space. With this reality, the need arises to invest in multifunctional rooms, where not only the furniture is multifunctional, but also takes up little space. To answer this problem, new design trends and systems that allow people to live comfortably in a small space are emerging, as it can be seen from the development of multifunctional and retractable furniture. This type of equipment allows the user to configure the product to his needs at the time of use and can dismantle or tidy up the product when not in use, such as recessed wall tables or built-in beds, thus freeing up space and storage and allow the room to have multiple functions such as bedroom, office, living room and dining room. In order to understand what the best decision to follow is, a survey of examples was carried out with successful projects made with both flexible wood and retractable furniture. Some parameters were selected to compare the projects, namely the material, the manufacturing processes and their result. In this way it is possible to understand to what extent these projects are distinguished and their details. The following selection is therefore intended to help clarify issues such as the applications of flexible wood in furniture as well as retractable furniture and its processes. These are six of the eight projects that were studied because they have applications in multifunctional furniture and retractable furniture. These contribute to the present project in a way that it is possible to understand what exists in this area and to what extent it can be innovated.

## PROJECTS



Fig. 8. Ollie Chair (2017) and Ollie Table (2018) - RockPaperRobot [11] [12]



Fig. 9. Shift – Benjamin Hubert and Layer (2018) and Wellenreiter – Dukta and Hochschule Mainz (2017) [13][14]



Fig. 10. Modus - Dukta and Creatop AG and Accord CED 102 – Accord [15][16]

From the projects studied, we can verify that several are multifunctional or retractable, however, none of them respond to these two characteristics simultaneously, and this is a point to consider. Since there is no furniture in this material that is both multifunctional and retractable at the same time, the opportunity arises to use flexible wood for this purpose, due to the possibility of the wood to adapt to various forms and return to its original form, which is

ideal for retractable furniture. Taking advantage also of its aesthetic characteristics, as it is a material with a very pleasant appearance in any situation and it is even possible to customize its color. This product can be used by all wood lovers, but it is especially designed for young adult students or workers living in small houses or apartments, usually in cities and thus needing to use the same space for various functions.

### 3.2 DESCRIPTION

WoodFlex is a multifunctional bookcase with a retractable chair and table. It is intended for use as a table, chair, shelf and the ability to be easily retractable when not in use, becoming a panel with aesthetic and acoustic properties on the wall. One of the main purposes of this product is modularity, as it consists of three different and independent cells making Woodflex, a modular product. This allows the user to create various versions of the product using its components according to the user's need or space. It can range from the simple module with no internal structure for shelves, the module with the chair and the module with the table. It is also intended

to increase contact between the user and the material by allowing the user to be able handle and experiment the flexible wood. Due to its modularity, it is also possible to assemble or disassemble a module or replace it without affecting the others and also, to reuse the same module in another place or project. This project is distinguished in that is modular, multifunctional and retractable. Of the 4 projects previously analyzed using flexible wood, only two are retractable, which use materials outside the wood to make it flexible. This stand is distinguished by the fact that the wood only needs one production process for this purpose, needing only one mechanical connection to the main structure. The multifunctional projects presented are not fully retractable, and retractable projects perform no more than a function. In this way, the proposed project responds to both attributes, since it is the only one that allows to have a chair and table embedded in the same product and can also be used with shelves or hooks. All these elements are retractable or removable (shelves). Due to the characteristics of its pattern, it was decided that Dukta's "Janus" pattern cut is best suited for the purposes of this project.

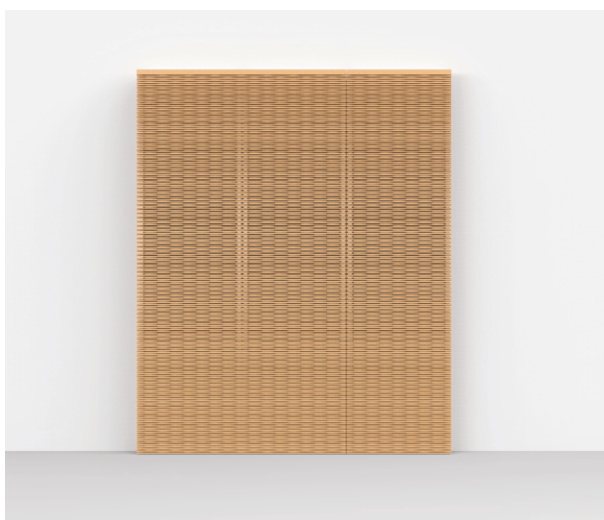


Fig. 11. Woodflex as a panel and all assembled.



To better understand the capabilities of the material, an experiment was performed with an MDF board with the Janus cut on the CNC. After the experiment, it can be seen that the material has become quite flexible and robust. There were no problems reported with the process at the CNC and the finishing was satisfactory. The test was performed with 5mm between the cuts, having such a positive result, the board model to be used in the project could be done with a smaller scale of these cuts, for more flexibility. As noted above and as can be seen from Fig. 12, an experimentation of the board as a chair and as a table was made, where it was possible for the

user to have contact with the material, to observe the behavior of the board in these situations and also to experience the its comfort.

In addition, numerical simulations were performed after the conclusion of the virtual model, from which it can be concluded that the main structure and the wooden board support the normal weight of a person (the weight used in the simulation was approximately 150 kg) and the weight used in the shelf simulation was approx. 15kg. The results can be seen in the following pictures.

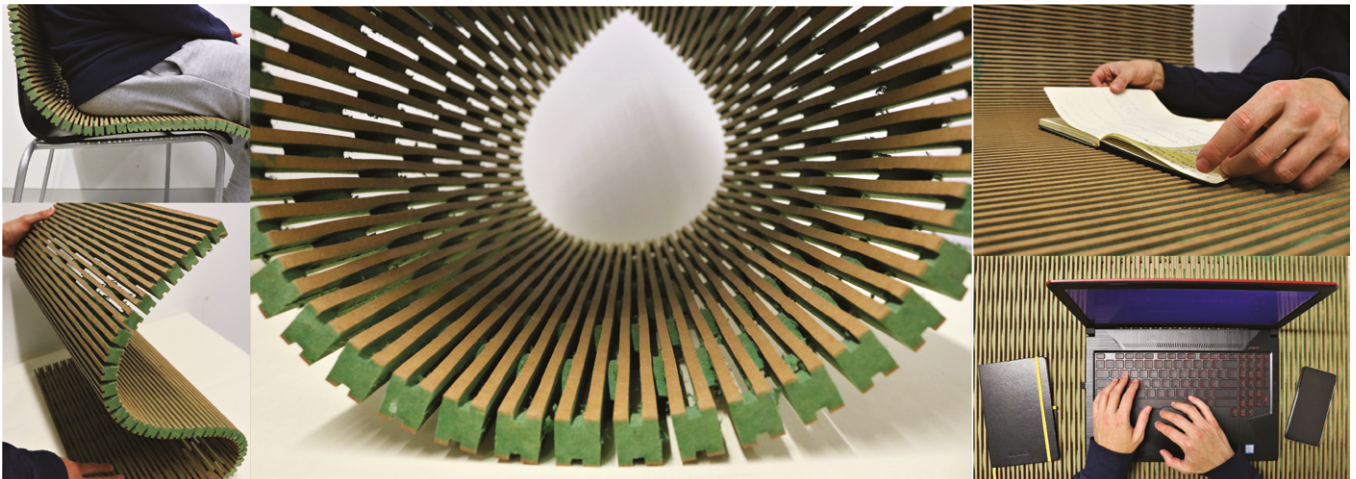


Fig. 12. Prototype board in MDF

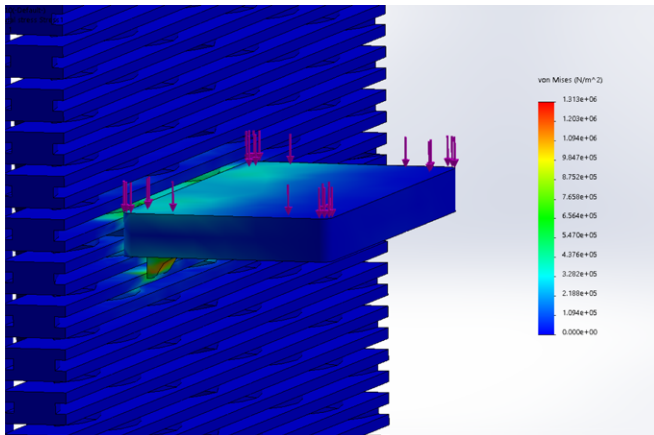


Fig. 13. Result: Yield Strength of MDF: 18MPa; Von Mises Tension max: 1,3 MPA

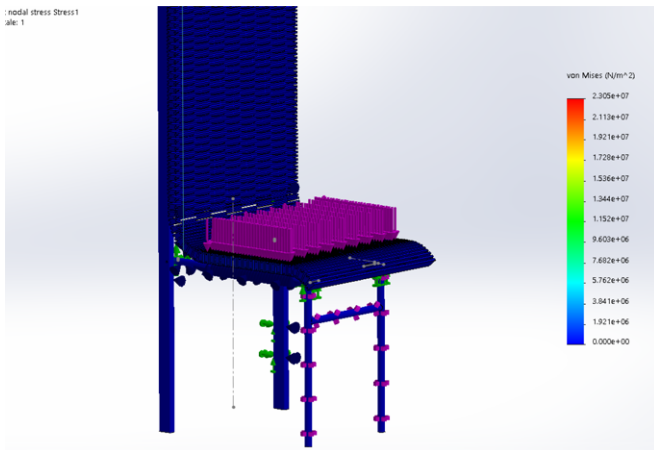


Fig. 14. Result: Yield Strength of Steel: 235 MPa; Von Mises Tension max: 15 MPA

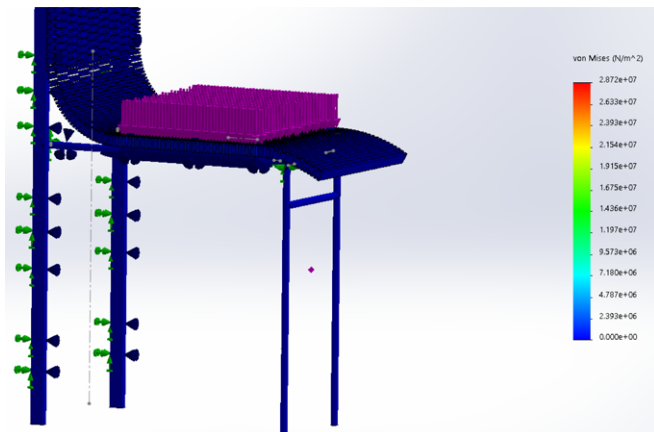


Fig. 15. Result: Yield Strength of Steel: 235 MPa; Von Mises Tension max: 28 MPA

**Modules.** The three modules of WoodFlex consists of a simple, a chair and a table module as it can be seen in Fig.16.



Fig. 16. Modules of WoodFlex

**Systems.** To facilitate the modeling process and subsequent part classification, the mechanical systems present in the product were divided into two systems. The locking system and the retraction system. The locking system consists of a bolt and a support and protection plate. Its purpose is to lock the legs when the chair is assembled, preventing it from closing unexpectedly and counteracting the retraction system. The chair/table only closes when this latch is unlocked.

The retraction system consists of a torsion spring and two stops that are connected to the shaft of one leg. This system is responsible for making the legs retract automatically when the locking system is unlocked. The ends of the spring are connected to the stops, as one of these rotates with the legs, the spring tries to pull them to their initial position. The torque exerted by the spring ceases to be counteracted when the lock is unlocked, this causes the spring to return to its original shape, causing the legs to retract. These systems work in the same way and with the same chair and table components, where the difference is found in the type of spring used in the table retraction system that will be adapted to the heavier

structure. Following are some of the details of the project, namely: additional components, overall dimensions, human scale and contexts of use.

**Additional Components.** During the design and modeling of the product, it was found that the wood board could not bend naturally with the movement of the internal structure due to the smooth nature of the polished metal. To prevent the wood from slipping or moving when the inner frame is assembled, two 10cm fabric sleeves (4 in the case of the table) were placed. This causes friction between wood and metal, which makes the movement of the wood board difficult. (Fig. 17).

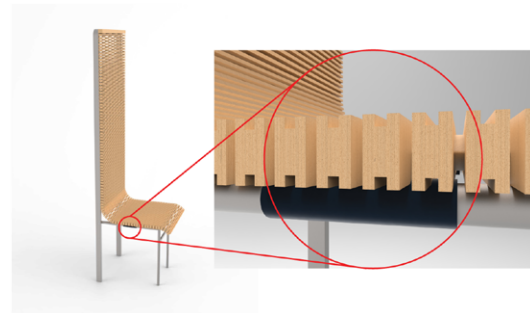


Fig. 17. Detail of the fabric on the internal structure

**Overall Dimensions.** The Fig.18 illustrates the overall dimensions of WoodFlex. When closed, the chair and table modules have the same width as the simple module. All measurements are in cm.

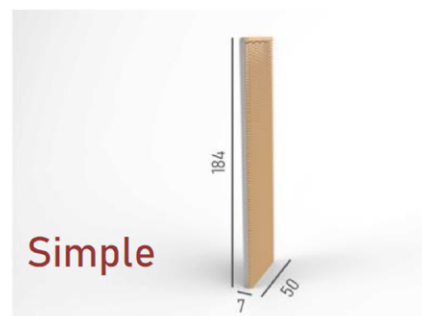
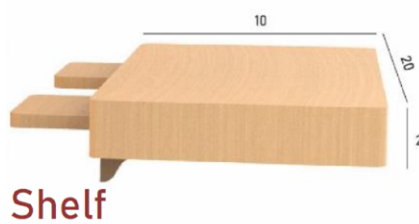


Fig. 18. Overall dimensions of WoodFlex

**Human scale.** Ergonomic and anthropometric measurements have been considered as references in the product development. Thus, to interpret the context of use it is necessary to consider the human scale. Fig.19 illustrate people's use of WoodFlex and its size and relationship to the product.

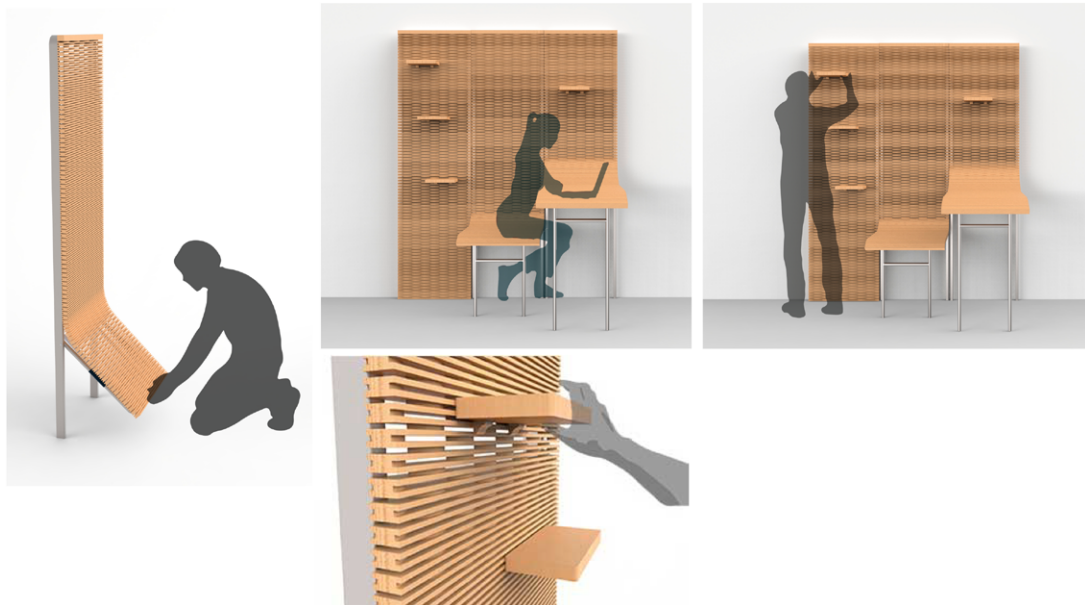


Fig. 19. Human Scale

**Use contexts.** As stated before, WoodFlex is ideal for use in small spaces, so it is suitable for use in a living room or bedroom, as a panel or shelf to take up little space, and a chair and table only when needed. Its use also depends on the

quantity and type of modules to be applied, as it will be according to the user's need. Since wood is the visually dominant material in the product, it offers a feeling of comfort to the space. Wood can also be customized for this product. The following are some contexts in which the product can be inserted, namely: living rooms, kitchens and bedrooms of different sizes.



Fig. 20. Two modules of WoodFlex in a living room





Fig. 21. All modules of WoodFlex in a kitchen/living room space



Fig. 22. Two modules of WoodFlex in a bedroom

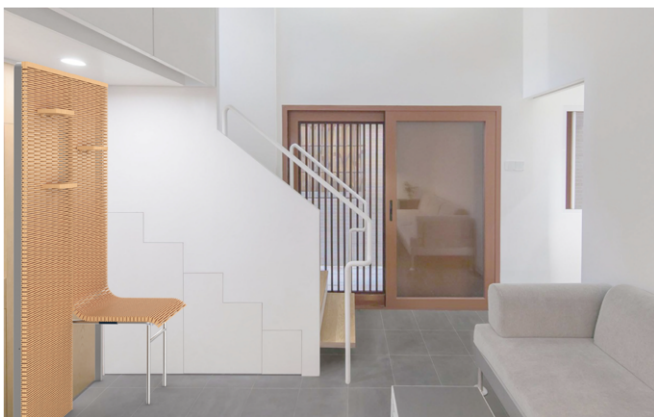


Fig. 23. Two modules of WoodFlex in a small living room

## CONCLUSION

The purpose of this project is to apply flexible wooden structures in furniture design. It aims to take the potential of these structures further by widening the range of their currently limited applications. It also explores the possibility of bending wood and at the same time benefit from its mechanical properties, namely strength. With the development of WoodFlex, it is considered that the perception of a material such as wood typically recognized as rigid, which in some cases makes its application in these areas difficult, takes new contours with this study. It is found that when using the technique created by Dukta, it gives flexibility to the material that would not be possible until then. Thus, it is demonstrated that this project had relevance in its conception, and that there are possible areas to be explored in this subject and in relation to this material, this could only be a beginning for the application of these structures in furniture. This product responds to the growing demand for multifunctional furniture as, as mentioned earlier, people are increasingly looking to live in small functional houses in urban areas where space is limited.

With this project, it was possible to give a new application to these structures. In effect, the retractable components of WoodFlex, its modularity and wood flexibility give a multifunctionality to the product that makes it ideal for use in small living spaces. In this way, WoodFlex is not only flexible regarding the material, but also in the many possibilities of application. With the technique developed by Dukta, it is open a world of opportunities to find new applications where flexible structures are an added advantage, such as retractable furniture and also our project WoodFlex.

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# Identity, food and culture: “Taste without waste”

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## Abstract

Food and the practices related to its production and consumption cover a symbolic value, expression of the local identities in a world witnessing product globalization and taste standardization. Food is realized using the noblest part of precious raw materials which, according to climate, culture, history and folklore, embody the true essence and spirit of the territory. As in an handmade process, they are transformed by tools and expert hands for obtaining a final product. What in this phase is discarded, rather than becoming a waste, can become a matter for “sustainable making”, inspiring designers in the making of new materials and products able to provide a plus of emotional experience. The paper will present the ongoing research project “Taste without waste”, which carries out the virtuous process through which matters becomes food, waste and then new materials and products. The food waste is not considered as a filler anymore. Through the exaltation of its sensory-perceptual features, its re-use and re-evaluation is seen as a tool for the valorization of the territory and its uniqueness, as well as a tool for people eco-education. Design joins the relevance of territory valorization thanks to its ability to see and emphasize what materials and product can express, inspiring changes and promoting ethical attitudes and behaviours.

## Keywords:

**Food Waste, Material Experience, Eco-education**

## 1. FOOD AS EXPRESSION OF LOCAL IDENTITIES

The crisis of modernity has caused a universal need to promote the cultural values as a common thread of human evolution (Dematteis, 2001), and to fight the deterritorialization process. The aim is to increase the growth of local societies respecting the difference and specificity of cultures, through direct actions on territory. Food is one of the few sectors that didn't suffer the effects of globalizations in term of cancelation of consolidated uses and habits. This is particularly noticeable in Italy, globally known for its biodiversity embodied in the typical food culture. What was before considered natural heritage of different local cultures becomes now driving force for territorial marketing actions, guided by the envisioning and communication abilities of design. The food system is now considered a cultural code, a language that expresses the membership criteria of individuals in a cultural group and consequently the belonging to a particular place (Caldo, 1990). Over time, food culture showed its strong connection with territorial geographies. It allows to understand the reasons behind the employment of a particular resource in a particular environment. In addition to its material dimension, related to typicalness of each place, food is a social construct, vibrant element of the immaterial heritage identified both in processes and systems of its production and sale, and in the practices and habits of its consumption (Banini, 2003). Recognizing this values is the first step for a safeguard process from the cultural and economical homologation and the loss of the "nature" of places.

## 2. FOOD WASTE AS NEW RESOURCE THROUGH DESIGN

The topic of food waste raises worries as well as targeted actions from governments for re-use and awareness increase on such topic. Food wasting happens at different levels within the food chain. It happens in three main stages: production, and so during farming, harvest and processing or raw matter; distribution, which means during industrial transformations and because of overproduction; consumption, that is to say catering and domestic use. In this last stage we have the most consistent waste, especially in large urban areas with a population of 10 million residents, where the garbage production is about 18% of the national one.

With the alteration of planetary equilibrium in terms of materials and resources, there is today a growing awareness that what was abundant in the past is not anymore abundant in the present, and what is abundant today could not be abundant in the future. As a consequence, designers started looking at waste as a valuable resource for the production of new materials. The aim is to eliminate the concept of waste, and expand the equilibrium condition of natural systems – based on the equivalence "waste equals food" (Braungart & McDonough, 2002) – to artificial systems of human production. As Lohmann says "there is no such thing as throwing away", "away doesn't exist" (2018). Today therefore, issues about production and disposal of materials and products have become a central concern within the design culture. In particular, the ability of design to prefigure future scenarios plays a key role in looking at waste from a different perspective. It is able to make the most of it not only as raw material, but as a vehicle of semantic and sensory features, able to give to the final artifact a strong characterization.

## **2.1 FOOD WASTE AS A TOOL FOR VALORIZATION OF TERRITORY**

Food is realized using the noblest part of precious raw materials, which, according to climate, culture, history and folklore, embodies the true essence, and spirit of the territory. Raw matter is manufactured, processed, and turned into food, just like food waste is manufactured, processed, and turned into material. The transformative action is common to both experiences that come together in the project. The raw material is shaped through manual processes, with a strong symbolic and emotional value given by individual or collective memories and traditions. Therefore, cooking becomes an action on matter aimed at the valorization of the organoleptic properties of the raw materials derived from the territory, which will be appreciated during its consumption. Foods' typicalities lies in the variety other than in the practices used. The uniqueness that each geographical place imprints on the raw material in terms of morphology, colors, odours and flavours, strongly influenced by the landscapes characters. These same properties belong to food waste as well as the valuable raw material used for cooking. Through a similar enhancing process of their sensorial perceptive qualities, they became material, than product, able to narrate its own territorial variety. Waste is often the most external part of a food, the one that relates directly with the environment and acts as a protective shell from elements and environmental factors responsible for its content degradation. For this reason waste can show places' diversity signs even better than the food itself, and those signs are consequently shown in the material derived from them.

Giving new life to an otherwise unexploited resource allows to produce an economic enhancement as well as a cultural one: it means to provide a no-cost usable raw matter; it means activating processes and wheels related

to management, transportation and waste collection in a local context in order to capitalize their potential in terms of employment and development.

## **2.2 FOOD WASTE AS NEW MATERIAL FOR EMOTIONAL MAKING**

In the food production raw matter is transformed by tools and expert hands. What in this phase is discarded, rather than becoming waste can become matter for sustainable making. At the same time can inspire designers in the making of products able to provide a plus of emotional experience. The perceptual features of raw matter and ingredients are embedded into materials, and so transferred to the final product, creating artifacts able to stimulate our senses. Starting from studies on synesthesia, it has indeed been demonstrated how our senses work simultaneously, and cross-modal interactions actually happens in every brain, that this is perceived consciously or not (Cytowic, 2018). Therefore, in the real world, we don't live isolated sensory experiences, since each sensory modality is highly influenced by other senses. Perception – result of synthesis and subsequent abstractions which integrate the informations coming from each sense in a space-time continuum (Buiatti, 2014) – is then multi-sensory.

As concerns food, the visual aspect – color in particular – is essential. It is necessary from the evolutionary point of view in order to recognize spoiled foods, and can strongly influence the perception of flavour of the food we eat (pink colorant will result in a sweet strawberry taste, orange colorant in citrus fruits taste and so on). Taste and smell instead, differ from other senses because from the neurological perspective, instead of having a synaptic relay in the thalamus, they synapse directly into the cortex of rhinencaphalon ("smell brain"). This means that they are closer to the hippocampus, a

crucial structure in the memory construction. For this reason they are more likely to evoke multi-sensory memories. Moreover, they constantly interact with one another, resulting in what we call flavour. Therefore the experience of eating, and so the flavour perception, involves different sensory stimulations – smell, taste, trigeminal system, touch, and somehow also sight and hearing – combining them into a whole percept (Auvray & Spence, 2008).

Raw matter employed in the making of materials results then in a synesthetic experience for the user, stimulating touch, sight and smell, reproducing colors, odors and textures of food. When associated to the tasting experience, this can provide a plus of emotional experience. Synesthesia indeed “can be looked on as a shorthand way of attaching meanings to things”, and “meaning is intimately entwined with emotion” (Cytowic, 2018). Waste bio-materials have a strong perceptual-sensory connotation which makes them valuable despite their low performance. Combining them with the synesthetic food tasting experience appears to be not only a way to valorize the territory, but also a way to trigger a revaluation process of the material itself, which acquires its peculiarities.

### **3. “TASTE WITHOUT WASTE”: IDENTITY, FOOD, CULTURE**

The ongoing research project “Taste without waste” carries out the virtuous process through which matters becomes food, waste, and then new material. It intends to show the potential of the experiential approach to materials in terms of exploration of sensory-perceptual features, as well as in terms of communication and education. The material becomes an essential cognitive and didactic tool which. Through interaction, it pushes to discovery and exploration, involving and stimulating each sensory modality simultaneously.

Material tinkering and direct manipulation appears to be essential for the designer in order to identify the most suitable strategies for reevaluating food waste. Craft practice is a means for “logically thinking through senses” (Nimkurlat, 2012), and the experiential approach to materials and design gives life to a continuous hand-mind collaboration. This approach allows to design the sensory-perceptual experience of the material, conveying values and meanings through it. On the other hand, material tinkering as a cognitive tool is important also from the user’s point of view, able to build a wealth of experiential knowledge about biomaterials from scraps, and so eco-educate to circularity and re-use of waste. The project addresses children of primary and secondary school, to show them the possibilities given by Circular Design. Here re-use and re-evaluation of food waste becomes both a tool to evaluate the territory and its uniqueness as well as a tool to eco-educate children and people in general. It is carried out by the PhD students in Design from Sapienza University of Rome and MaterialDesignLab, under the supervision of the scientific director prof. Sabrina Lucibello, and it is funded by Lazio Region through a call<sup>1</sup>.

“Taste without waste” focuses its attention on the food culture and the local products of Lazio, a region in the middle of Italy. It aims to re-use and re-evaluate food waste from its typical dishes, in general, derived from the precious part of native raw materials. In particular, it is used for the DIY production of biodegradable bioplastics, used in turn to realize a tableware set. Preserving some of the sensory properties of the waste employed – such as colors, odors and textures –, the tableware is able to give back each food’s peculiarity.

The first phase consisted in a laboratory experimentation focused on the do-it-yourself production of material samples using food scraps

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<sup>1</sup> Call for Events, Lazio Region, n. G13950 – 5 November 2018.

from traditional local delicacies (Fig. 1– 3). The sample produced were bioplastics obtained by a mixture of organic ingredients combined with food scraps from some typical raw materials like the PGI artichoke from Rome, the PDO chestnut from Vallerano; the PGI kiwi from Latina, the PGI potato from Alto Viterbese, the PDO pepper from Pontecorvo, the PDO olive oil from Canino, the homemade bread from Genzano, and so on. A variety of samples has been realized, varying color, thickness, consistency and flexibility for each material category, adding or removing food waste and varying the recipe.

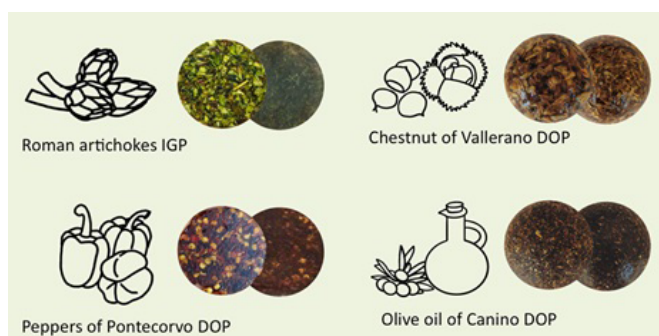


Fig. 1. Examples of DIY bioplastic produced using food scraps from traditional local delicacies of Lazio Region.



Fig. 2 Examples of DIY bioplastic produced using food scraps from traditional local delicacies of Lazio Region.



Fig. 3 Examples of DIY bioplastic produced using food scraps from traditional local delicacies of Lazio Region.

Subsequently, three educational workshops<sup>2</sup> has been organized involving children in the self-production and material thinking with a dual objective: educate to re-use and circularity and achieve feedback about the sensory qualities of the realized samples (Fig. 4 – 5). Children are a blank slate, free from any conditioning when approaching to materials. For this reason it's been interesting for the research to involve them in activities aimed at gaining experiential knowledge on the sensory and emotional involvement given by the DIY materials. In particular, some games have been organized asking children to interact with the material samples, to evaluate their properties on “gradient scales”<sup>3</sup> and to imagine the possible uses and applications. As a result, besides imaginative scenarios of possible futures, we got many diagrams and photos of children interacting with materials – capturing their expressions, mirror of their emotional involvement. Moreover, the approach employed in the evaluation of sensory-perceptual features

<sup>2</sup> “Possibile se Sostenibile” workshop on July 2017, and “Plastiche @ Bioplastiche. Scopriamo come riconoscerle” workshop on September 2017, in collaboration with Explora – children’s museum of Rome; “Bioplastica Preziosa” workshop in collaboration with Sapienza Research and Services Center SAPI&co for “Maggio Museale” 2019. Scientific Director Prof. Sabrina Lucibello, Sapienza University of Rome.



overcame the traditional methods that wrongly don't account for synesthetic convergences of senses and perception subjectivity.



Fig. 4. “Possibile se sostenibile” Workshop on July 2017, in collaboration with Explora museum.

Starting from a brainstorming on the workshops' results, the third phase consisted in the making of a biodegradable bioplastic tableware set, realized for eating the specific dish from which the food waste was derived (Fig. 6). With some selected biomaterials from the experimentations, almost one for each dish, some tableware, cutlery and packagings were prototyped and realized. Each of them, thanks to the sensory properties of new materials as well as to specific morphologies, is able to give back food's organoleptic properties and to augment its peculiarities. The food waste is not a filler anymore – hidden and not valorized. It is a mean to attribute meaning to artifacts and to stimulate change through design promoting ethical attitudes and behaviors. Shapes instead, were designed starting from the aesthetic-

<sup>3</sup> In order to facilitate the evaluation of sensory-perceptual features, some gradient scales have been realized. It consisted in diagrams including the traditional categorization of senses – sight, hearing, taste, touch, smell – as well as cross-modal interactions – chemo-reception (smell-taste-sight), thermos-reception (touch-taste-hearing), pleasant-ness, and so on. For each category have been identified the specific properties and their opposites, located at the two ends of the gradient scale, allowing to quantify the perception of the material.

perceptive characterization of the bioplastic produced and observing the gestures, movements and habits of people approaching each specific dish. In this way the final product is able to stimulate one or more senses, augmenting the tasting experience and generating synesthesia.

Then, as dissemination of the research results, a performance event is going to be arranged. Users will be able to immerse themselves in a journey from the raw material to the final product, tasting local delicacies with the tableware realized from their own scraps. The event will consist in a performance, an exhibition and a lecture, and will involve the participants in an immersive experience that unites the food tradition of Lazio Region and Design. It will provide the understanding of how to design with and for food, developing at the same time innovation and tradition.

In particular, the performance aims to realize a “Taste Experience”, characterized by the reinterpretation of some dishes typical of Lazio region by the starred Chef Andrea Fusco. It is going to be organized with the advice of Foodhouse, a Roman society nationally established which deals with Experience Design and Eating&Tasting Design. It will be based on local raw products and wines and will present some evolutions “possible if sustainable” of the traditional food, tasted in the tableware set derived from their own scraps. In conjunction, the exhibition aims to realize a “Taste Floor”, namely a real scenery able to help people understand how the raw material can be at the same time new material. It'll show the virtuous process through which the matter become food, waste and then a new bioplastic, useful for new biodegradable products able to provide a plus of emotional experience. Thus, to eat a plate of PGI potatoes from Alto Viterbese with tablewares derived from their skins can become a very interesting experience. Moreover it can foster reflections

and critical thinking on the environmental issues, inspiring changes, and rising awareness about the impact that our everyday life has on the environment. The culinary performance aims at creating a small circular process: waste from dish preparation become themselves raw matter for the making of the tableware. In addition, the catering industry considerably contributes to food waste production, and is an activity which closely involves the community. In this way we want to instill the awareness that is possible to act individually everyday, instead of passively delivering change to large production and distribution industries.

Finally, a lecture will talk about the potential of biopolymers derived from food waste, thanks to the contribution of academicians, entrepreneurs and food designers. It will be also the occasion to discuss with them how food waste can be push to reread in a contemporary key the identity of the territories and their materials.



Fig. 5. "Possibile se sostenibile" Workshop on July 2017, in collaboration with Explora museum.



Fig. 6. Prototypes of a tableware set made of bioplastic derived from food waste. Each piece is shaped in order to enhance the sensory properties for a more involving taste experience.

## 4. CONCLUSION: RELEVANCE OF THE PROJECT

The project fits into a set of strategic actions aimed at promoting new productive and cultural models in the field of Circular Economy. From the European Commission's guidelines indeed, emerges how the effectiveness of the proposed actions requires local communities' participation and protagonism. Concrete measures about issues as recycle, biodegradability and waste reuse, appears to be effective only if they interface an informed, active and aware population. In order to achieve the Circular Economy goals so, is necessary to start a virtuous path based on three key points: an Industrial Revolution, of processes, technologies and resources consumption; a Legal Legislative Revolution; and a Cultural Revolution, through environmental education and active participation.



The goal of “Taste Without Waste” project, part of Sapienza research “*Design & Territorio. Tra memoria, tecnologia e “saper fare”*”<sup>4</sup>, is then to contribute to the Cultural Revolution, educating to reuse, waste reevaluation and reflection about food waste. It does this turning mainly to children, but also to adults, through an active and engaging experience. Design assumes the role of catalyst, able to let the productive models implemented by the companies spread through a familiarisation process, and in this way penetrate in a capillary manner into everyday life.

Designers have the ability to influence behaviors and thought patterns through the aesthetical-perceptual features of materials and products. This appears to be essential today for diffusing new values into society, raising awareness about the impact that our everyday life has on the environment. Thanks to their envisioning skills and the ability to find alternative ways to face the contemporary complexity, designers act as catalysts of innovation. Their action reaches also fields far from the most advanced technology, as the ones of food and territory uniqueness. In particular, it is able to display tangible alternatives to the current development model, stimulating users’ interest and engaging them in the envisioning of future scenarios to shape a conscious and responsible world.

In this research project, the emotional and physical involvement has been employed in order to encourage attention and memory. As Kolb

says talking about what he defined the “learning cycle” (Kolb, 1984), the experiential learning is based on the principle whereby our brain is able to acquire concepts, ideas and relations more effectively when driven to put them into. Consisting in four phases – concrete experience, reflective observation, conceptualization and active experimentation, such approach provides for the cyclical turnover of practical activity and theoretical processing. Therefore, its application in eco-education entails the engagement of senses which, as preparatory activity for knowledge construction, represents the key element for learning.

The project goes from the material production to the evaluation of its sensory qualities – exploring smells, tactile surfaces, colors and textures, and establishing a hierarchy of the more influential features over the material appreciation – up to the experience originated from its use through tasting. In this way it acts as a “learning cycle” allowing individuals to discover how the historical and agronomic memories of a territory can become an added value. At the same time, it allows to conceptualize the potential for change of behavior patterns, providing a practical demonstration of how this changes can represent a pleasant plus for users’ experiences.

<sup>4</sup> “Design & Territory. Among memory, technology and “saper fare”. PI: Sabrina Lucibello, that investigate the effects that new technologies are holding on material culture, with respect to design, technological and material “memory” of Italian territories: from the modification that investigate the effects that new technologies are holding on material culture, with respect to design, technological and material “memory” of Italian territories: from the modification of languages and advanced techniques for the products produced in our tradition, to a rereading of the disciplinary comparison that has always existed between artisan culture and design culture.

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# Case Study on the Development of the BUGA Fiber Pavilion 2019: Analyzes on Biomimetic Materials and Digital Fabrication Aspects



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## Abstract

This Case Study presents analysis on the development of the BUGA Fiber Pavilion 2019 conducted at the University of Stuttgart in Germany. This institution has tradition in bio-inspired projects since the research carried out by architect Frei Otto and, more recently, through the creation of the ICD (Institute of Computational Design and Construction) has been conducting several experimental research pavilions, exploring new configurations, design processes and architectural fabrication. One of the most recent of these pavilions is the BUGA Fiber Pavilion 2019, here will be a case study based on analysis of aspects of biomimetic materials developed using robotics for digital fabrication, especially fiber composites. The aim of the study is to justify inspiration in nature as an efficient factor for the development of artifacts with innovative materials and configurations. It also proposes to demonstrate how the combination of cutting-edge computational technologies with constructive principles found in nature allows the development of new and digital building systems. In the biological context, most load-bearing structures are natural fiber composites, made from fibers such as cellulose, chitin or collagen, tied to a matrix material that supports them and maintains their relative position, ensuring their performance. and resource efficiency from these fibrous systems. Its organization, directionality and density are fine-tuned and varied to ensure material is placed only where it is needed. Thus, the analogy of this biological principle of natural fiber composite systems was transferred to this pavilion. Synthetic composites such as glass and carbon reinforced polymers were used because they share their fundamental characteristics with natural composites. Thus, the main structure of this pavilion is made up of 60 uniquely manufactured custom-made fiberglass and carbon composite components, each weighing approximately 7.6 kg per square meter, which corresponds to five times lighter than conventional steel, resulting in a lightweight structure with authentic architectural expression (Menges, 2019; University of Stuttgart-ICD, 2019). Carbon Fiber Reinforced Polymers (CFRP) are considered high performance materials, known mainly for

their use in the aerospace, automotive or sports industries, which because of this feature constitute great potential for application in architectural constructions or product design. According to collected data, the manufacture of fiber composite structures combined with recent advantages in computational design allows the analysis, abstraction and transfer of principles of biological construction through software such as Grasshopper, where it is possible to transfer evolutionary principles in the design of digital models, and from these, simulations are made for greater material efficiency than conventional building systems. (Menges, 2016; Menges et al., 2017; Yuan et al., 2018). Another feature of these fibrous composite materials is that they allow adaptation to structural requirements in complex multifunctional geometries, being compatible with the robotic filament winding process, which result in excellent stiffness, strength and lightness properties, making this material efficient for lightweight constructions. Moreover, the versatility of the material allows variations of these composites (varying the type of high-performance carbon fiber reinforced polymer; or natural fibers; or bio resins; or economic reinforcement only with fiberglass, among others). Each of these types will offer different qualities of appearance and performance. Compatible with a variety of dyes, fibers and matrix materials, a wide variety of colors, transparencies and surface finishes are available (FibR, 2019). From these analyzes, it is found that the BUGA Fiber Pavilion 2019 bears analogy with this efficiency of nature, resulting in a highly innovative artifact, either through new and more effective materials and construction processes, with the creation of lighter structures. , articulated, flexible and high performance, or even by incorporating technological tools that enable the translation of more organic forms, facilitating the design of these new models based on natural references through computer controlled software and machinery for construction, evaluation and manufacturing models in line with sustainability, expanding the potential of new and different applications.

### Keywords

**Game Design, Creative thinking, User experience, Methodology, Playful design**

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# Track

## Design for Self-Reflection, Imagination and Disruption

*Critical and speculative design can be an effective tool for exploration – both of the society and of the design discipline itself. It can also have a strong emancipatory effect on the designer, leading to more ethical and sustainable design practices. The change can be achieved by means of disruption, ambiguous inputs, quiet questioning or in many other ways, as the method is dependent of the circumstances and the expected outcomes.*

*Design for self-reflection, imagination and disruption aims for a rational reflection on the challenges emerging from contemporary society. Whilst drawing creative solutions supported by rational processes, it disrupts reality as we know it, improving human / community experience. This track welcomes new ideas – as well as real-life experiences to learn from – on how to foster a productive self-reflection and promote imaginative approaches in design. We are also eager for contributions that would allow us to discover the outcomes of said approaches.*

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# Data Portraits as Tools of Self-reflection and Awareness

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## Abstract

This study focuses on the creative exploration of personal data as raw material for the creation of portraits, considering how our contemporary existence is constantly mediated by an expanding array of digital technologies, capable of recording various aspects of human life as digital data.

It starts by discussing the “informational nature of personal identity” according to Floridi (2011), regarding how identity can emerge from personal data, and addresses the concept of “data portrait”, as defined by Donath (2017), as an expression of identity based on the individuals’ digital footprint. It then approaches the notion of “technologies of the self” as described by Foucault (1988), in order to explore how data portraits can be regarded as tools for self-analysis via self-tracking or means of attaining human agency through data.

The aim of the study is to promote discussion on the representation of identity, at a time when increasing amounts of personal data are accessible. We seek to highlight the relevance of data portraits as creative experiments around the representation of personal identity and the way in which the self can, in turn, be shaped by digital culture.

## Keywords:

**Personal data, data portrait, identity, technologies of the self, human agency.**



## INTRODUCTION

Our contemporary existence is continuously mediated by digital technologies and from this mediation large sets of personal data emerge; be it data resulting from direct human interaction with these technologies or data passively registered by sensors embed on digital devices that, regardless of our awareness, constantly collect data pertaining to their user's actions or surroundings. In this interconnected world, large amounts of data can be related to a specific individual, as part of their digital footprint. Consequently, each of us has a unique data trail, which can be parsed in order to produce information and visualized to express meaning. Motivated by the expressive potential inherent to these data trails, this research aims at exploring how data portraits can be interfaces for self-tracking practices, becoming a tool of self-observation and self-awareness. To this end, it addresses how personal data can become an instrument of self-reflection, allowing us to better understand ourselves and, at the same time, make sense of others. It also considers how our daily use of common digital technologies structures the way in which we look at ourselves, debating the implications of this mediated self-observation processes.

Following these ideas, the study focuses on the creative exploration of methods of self-representation through digital data, following a theoretical and practice-based approach. It begins by discussing the "informational nature of personal identity" (Floridi 2011) and the concept of "data portrait" (Donath 2017), which are then framed as "technologies of the self" (Foucault 1988) or mechanisms of self-governance through data. This conceptual framework also informs the design and implementation of the project *Data Self-Portrait*, which creatively explores the visualization of personal data, automatically

collected by digital technologies of everyday use in order to express behavioural patterns, as a reflex of the one's identity.

In this manner, this study seeks to promote discussion on how portraiture can be reconceptualized, as informed by the creative possibilities of digital technologies and personal data, by taking advantage of the objectivity of data to represent human subjectivity. Data portraits can act as interfaces with our own behavioral and biometric data and express identity through our 'digital footprint', acting as biographical repositories of a technologically mediated life.

## THE SELF AS INFORMATION

The current dissemination of communication technologies is causing several changes in our daily lives, as globalization promotes the replacement of traditional patterns of identity, such as rigid gender roles, religion, or the nuclear family, by self-chosen ones. Consequently, people feel the need to maximize "their life chances in the context of uncertainty and unpredictability of contemporary life" (Lupton 2014). This "liquid modernity", as described by Bauman (2000, 31-32), leads to a normative mindset with an emphasis on shifting or impermanence, rather than on stability, and to the acknowledgement that the construction of the self is an ongoing endeavour or a "creative enterprise" (Hernández-Ramírez 2017).

The proliferation of computational technologies then creates new affordances for the development of our identities, in particular, when considering identity as an informational structure, as suggested by Floridi (2011). According to the author, "the identity of the self is grounded in the unity of consciousness and the

continuity of memories”, being regarded as an “auto-biographical artefact” (Floridi 2011, 9). So, following this informational approach, identity can be characterized as an “evolving informational structure” based on personal narratives.

The use of digital tools such as smartphones, personal computers, mobile cameras, online platforms, mobile apps and wearable devices enables us to track almost any aspect of human life and record it as digital data. As expressed by Wolf (2010) in our “data-driven life” “numbers are infiltrating the last redoubts of the personal. Sleep, exercise, sex, food, mood, location, alertness, productivity, even spiritual well-being, are being tracked and measured, shared and displayed”. Therefore, personal narratives that were previously based, mostly, on qualitative information, can now arise from multiple layers of measurable quantified data.

This tendency towards quantification is becoming widespread, as technologies become smaller, wearable and increasingly unnoticed, while collecting personal data. In this manner, the human senses and memory are being augmented by the affordances of technologies, creating “human-digital-assemblages” that work together “to make new things (‘information’)” (Lupton 2018).

## DATA PORTRAITS

In this context, data portraits emerge as a product of the quantification and visualization of personal data, produced in the course of daily experiences, and automatically captured by digital technologies of personal use. They emerge as visualizations that are conceived to deliver back to users their trails of personal data, that are unique to each individual. As such, Donath (2017) defines data portraits as “depictions of people made by visualizing data by and about them”.

The emergence of data portraits is then tied to a

cultural and ideological shift in the representation of identity since they prioritize “qualities that are not directly observable” relating to actions, behaviours and ideas, as socially relevant information that cannot be directly deduced from one’s appearance (Donath 2001). Thus, appearance loses its value and significance to the expressive potential of data as a raw material for portraiture.

Being tied to the representation of the subject’s behavioural traits, data portraits are also the result of an interdisciplinary practice that involves portraiture, autoethnography, data collection, visualization and computation (Sampaio et al. 2019).

They can be seen as an extension of the ways in which the portrait has been gradually reinvented, accompanying technological and cultural advances and following a tendency to detach itself from the mimetic representation of the physical body, by employing enumeration techniques and personal inventory as a form of portraiture. As such, the visibility of data portraits is the product of the visualization of personal data, collected through a process of systematic self-observation, mainly done in a passive way.

Although their visibility tends towards abstraction, data portraits can be coupled with the notion of “digital realism” (Min 2015), since the data they resort to is extracted from the real world, as an index of real occurrences. In this sense, they are no longer the result of a mimetic representation of the subject’s physical appearance, but rather the result of a symbolic organization of personal data into a visualization system that produces “informational images” (Renaud 2004).

The resulting visualizations often involve the representation of time, as means of expressing change and the fluid nature of personal identity (Bauman 2000), but also a distance from an analytical stance, concerned with legibility, favouring a subjective expression. And when taking advantage of the affordances of

computational medium, these visual outcomes can also have dynamic properties or be open to interactive exploration.

So, although different from traditional portraits, data portraits evoke the same expressive functions of their classic counterparts, as essentially tied to the representation of the individual before the other and/or before himself. On one hand, data portraits can fulfil a 'proxy' function. Namely, by representing individuals in virtual environments, while revealing their behavioural patterns (rather than appearance) and having an impact on others act towards them. On another hand, data portraits can act as a "data mirror, a portrait designed to be seen only by the subject, as a tool for self-understanding" (Donath et al. 2014). As a vehicle for the exploration of personal identity, the portrait becomes a data self-portrait, reflecting patterns of self-directed behaviour, by promoting an affective tie with one's personal data, as an effect of its visualization and due to its biographical qualities. Additionally, and by involving the re-appropriation of personal data, data portraits can also fulfil a political role by drawing attention to the loss of control over

our private information.

In sum, data portraits can be understood as representations of subjectivity, but are also visualizations of a subjective nature, regarding design choices on what is to be represented, and how, as well as to what end or expression. As such, their primary goal is "to call into question the claims of transparency, certainty, and objectivity" of data visualization, insisting in "the situatedness of the observer and the phenomenon being observed" (Hall 2011).

## PROJECT: DATA SELF-PORTRAIT

Drawing on these ideas, and on the premise that "we are our data" (Lupton 2016), we developed a *Data Self-Portrait*<sup>1</sup> that explores the expression of personal identity as it evolves through time and according to our digital footprint. The project is a visualization of behavioural and biometric data that approaches self-tracking practices and explores the potential role of data-portrait as technologies of the self, conceived to promote self-reflection and awareness.

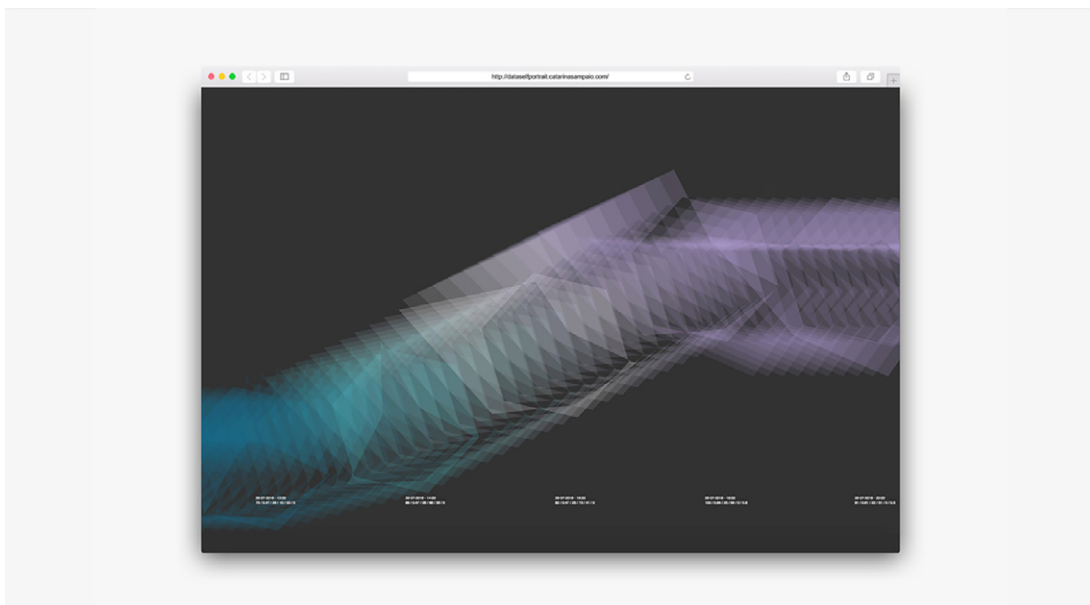


Figure 1: Data Self-Portrait, screenshot of the dynamic visualization.

In this manner, we began by defining which data could have an ethnographic value and would also cover different aspects of personal experience. We thus selected data from three distinct domains: biometric data, behavioural data and data related to the individual's surrounding environment. The data collection resorted to sensors embedded in devices of daily use, such as our mobile phone, a cardio bracelet, self-tracking applications and also records from our web browser. It was important that the data collection

could be automated in order to render the self-observation process more fluid.

*Data Self-Portrait* is designed to represent everyday life, unveiling hidden patterns of the subject's daily life. It highlights the variations in daily routine by comparing each measurement of data with the arithmetic mean of the total values of data collected. The visualization system then reflects these variations in terms of changes in geometric forms and its colours that fade when the user's activities conform to their everyday routine.



Figure 2: Data Self-Portrait, photo of the printed publication.

The visual outcomes of the project are essentially contemplative, in alignment with classic portraits. However, and since these portraits condense large amounts of information, we also wanted to allow its interactive exploration through a timeline. The geometric forms are meant to highlight the quantitative nature of the input data, and colour also plays an important role in the perception of its variations.

1 Website of the project: <http://dataselfportrait.catarinasampaio.com/>. Please notice that the website is optimized for desktop and for the web browsers Google Chrome and Mozilla Firefox.

With this approach, we were able to create complementary expressions of the same self-portrait comprising a printed publication, a physical output and a dynamic visualization. While the printed publication contextualizes the development of *Data Self-Portrait*, the physical output seeks to evoke aspects of traditional portraiture such as the crystallization of a moment in time, materialized for future contemplation. In contrast, the dynamic visualization is an evolving self-portrait that unfolds in time. As expressed by Morley (2007, 96-97) when

referring to these kind of autoethnographic approaches and personal inventories, the point of this exercise is not “to discover the new, the grandiose, the striking, the exceptional or the unexpected, but rather to (re)discover, or perhaps see well for the first time, the realm of that which is already familiar and, thus, largely unseen” given that “few of us give enough attention to what is truly daily in our daily lives, to the banal habits, settings and events of which those lives almost entirely consist”.

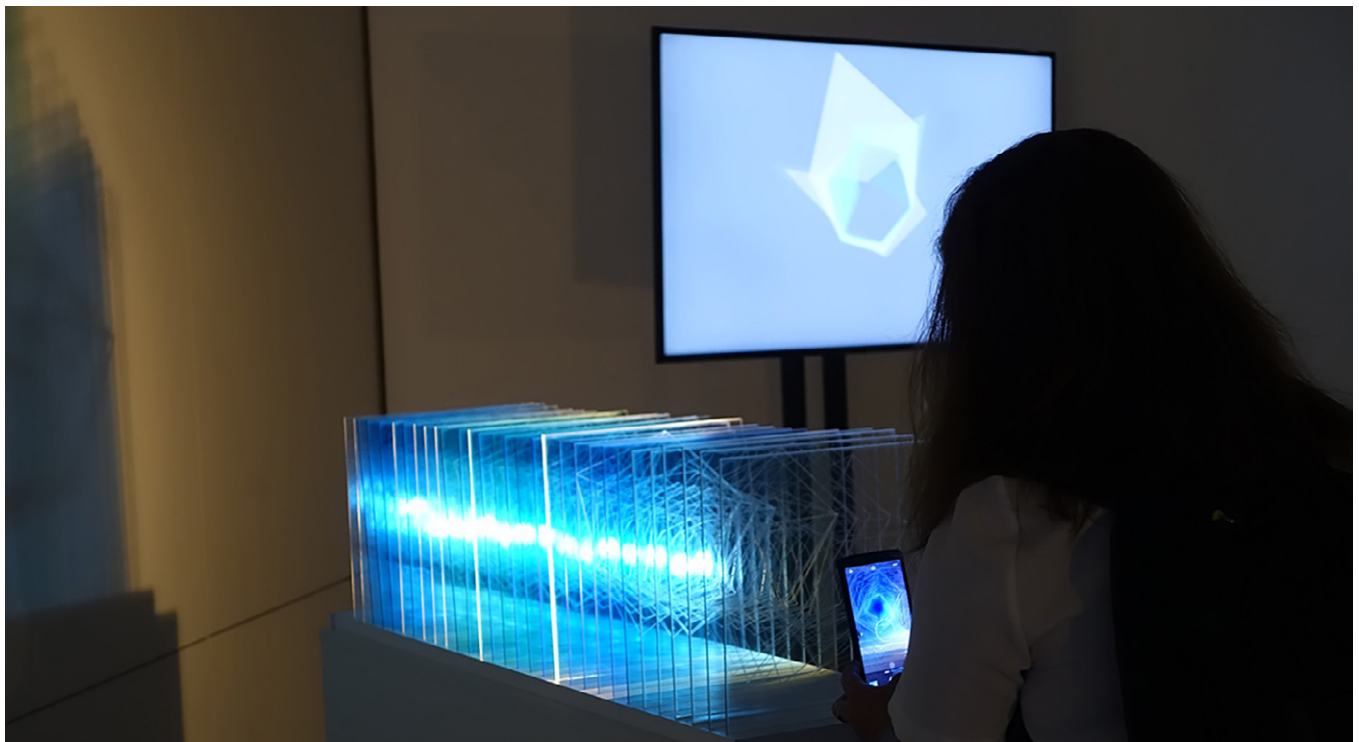


Figure 3: *Data Self-Portrait*, installation at ARTECH – 9th International Conference on Digital and Interactive Arts.

## DATA PORTRAITS AS TECHNOLOGIES OF THE SELF

Data portraits are, therefore, inextricably linked to self-tracking practices, as relying on digital technologies to automate the collection and



visualization of highly detailed sets of personal data. According to Lupton (2014) or Selke (2016), self-tracking is often considered a way to improve human life, allowing people to make better choices for themselves based on information about their own behaviour. It is “a reflexive mode of practice that is adopted by people as a way of learning more about themselves by noticing and recording aspects of their lives” (Lupton 2018). So, this practice can be understood as a way to achieve knowledge about oneself by “knowing the facts” (Wolf 2010), to take control over one’s life as a form of attaining human agency through data.

According to this idea, we can couple these self-observation processes with the notion of the “technologies of the self”, as described by Foucault, as “specific techniques that humans use to understand themselves” (Foucault 1988, 18). When studying the mechanisms by which human beings govern themselves, or “how an individual acts upon himself”, Foucault argues that part of a citizen’s social responsibility is to “take care of himself”, in terms of health, wisdom and overall wellbeing. These processes of acting upon oneself, as to reconfigure selfhood, incorporate “neoliberal values of self-responsibility for life”, which also entails “viewing selfhood as an entrepreneurial project” (Lupton 2018). Foucault defines technology as an abstract concept that encompasses the extension of human capabilities, and describes technologies of the self as mechanisms “which permit individuals to effect (...) a certain number of operations on their own bodies and souls, thoughts, conduct, and way of being, so as to transform themselves” (Foucault 1988, 18). Therefore, data portraits can be regarded as technologies of the self, or as mechanisms of self-observation through data visualizations that use computational technologies to enable the expansion of our senses and memory, therefore, also enabling new forms of human agency and self-governance.

## CONCLUSION

This paper addressed the informational nature of personal identity to highlight how we are the data that is produced by and about us. Therefore, personal narratives that were previously mostly based on qualitative information can now arise from multiple layers of quantified data. Data portraits can then contribute a reconceptualization of portraiture as a representation genre — one that is shaped by the creative possibilities of the computational medium and that becomes more attuned to our contemporary mode of living immersed in data. According to this view, this paper sought to explore how these representations of identity can be framed as technologies of the self that re-incorporate trails of personal data back into selfhood, or how they can promote a reflexive consciousness on one’s identity, enabling self-governance and self-awareness through data. In this manner, the project *Data Self Portrait* evokes some of the main representational and expressive functions of data portraits, namely as a data mirror designed as a tool for self-understanding. It also explores how data portraits can express our identity through our digital footprint, acting as interfaces with our behavioural and biometric data and as biographical repositories of a technologically mediated life.

As future research, we seek to further explore the potential of data portraits for visualizing behavioural patterns of individuals and for facilitating social interactions in digital environments, as well as their role in aggregating personal data and highlighting the implications of our digital footprint. We intend to further expound on the aesthetic and design options inherent to these non-mimetic representations of identity, as well as further debate the ethical issues pertaining to privacy and agency over data that is produced by and about individuals.



With this approach, we aim to explore design solutions that respond to the growing dematerialization of social interactions, by taking advantage of the objectivity of data to represent the human subjectivity, while tackling the subjective choices involved in the design of visualizations of personal data, as a means of representing identity.

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# Alternate “living” virtual realities: What are the implications for design?

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## Abstract

Over the years, the use of Virtual Environments (VEs) has become a common and daily activity performed by many users all over the world, especially in the entertainment field. Online gaming statistics indicate that over 35% of American users play Massive Multiplayer Online Role Playing Games (MMORPG). Such a trend indicates that we are on the brink of an ever increasing use of such environments as alternate realities, which may be problematic due to their immersive nature. For example, extensive research regarding the use of Virtual Reality (VR) in the treatment of various mental disorders (i.e., fears, phobias, anxiety, depression, among others), shows that even low resolution VEs have an impact on users' behaviours. Therefore, the role of design has become even more important as such environments imply, as well as involve a number of ethical and social factors that may seriously impact the way society presently functions. The potential for such factors having a ripple effect on society is even larger than those related to designing built environments. Whilst an industrial designer may struggle to implement a small change in a product, for it has too many implications - from production, to distribution, cost and value - in a VE, details can be limitlessly and boundlessly altered by a mere change in a line of code, without resorting to any usability assessments. Lately, the use of VR technology has become an important tool for the assessment of human performance and behaviour in numerous fields of action. The most common challenge in such studies is to always design/provide an optimal VE in which to conduct such assessments. Therefore, usability criteria are paramount to the success of user interaction within VEs. These necessities result in an ever more detailed alternate reality which may pose immediate ethical problems if not addressed properly. And although preposterous it may seem to change completely what we came to know as reality, there is nothing to prevent it. For instance, if one were to change the colour scheme of emergency signs in the virtual world, what would be the long-term repercussions for reality, or the way we perceive reality. Consequently, this paper provides a theoretical framework which seeks to highlight the main subject matters and case studies that focus on the design, implementation and evaluation of VEs, in order to understand which ethical and social challenges may arise.

## Keywords

Virtual Reality, Virtual Environments, Ethics, Usability, Design

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