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Perspectives on Design and Digital Communication III

Research, Innovations and Best Practices

Springer

Springer Series in Design and Innovation

Volume 24

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Perspectives on Design and Digital Communication III

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Preface

This book responds to the dimension of "anticipation" described as one of the dimensions of Design for Innovation by [1]. It aims at highlighting the social and civilizational responsibility of design and to describe how this is being carried out at multiple levels and in line with the priority established by the European Union in 2014, in the so-called agenda for Responsible Research and Innovation (RRI). The agenda gave a great focus to design for all, and to guidelines to achieve this, and was based on the recommendations by the European Design Leadership Board [2], in the report "Design for Growth and Prosperity." The report identified six strategic areas for design: European Design on a Global Stage; Design in Europe's Innovation System; Design in Europe's Enterprises; Design in Europe's Public Sector; Design in Europe's Research System, and Design in Europe's Education System.

In line with this paradigm, we also consider the four dimensions of design for innovation scalped by Stilgoe and Guston (2017): Anticipation, Reflexivity, Inclusion, and Responsiveness. They are expected to converge with the emerging transition design approach, which is being developed worldwide in multiple contexts, such as within the Carnegie Mellon [3] and the Great Transition Initiative (Peter 19 Sterling, February 2016 and https://www.greattransition.org/) [4].

This book aims at depicting the multifaceted nature of design according to the paradigms and trends explained above, offering a timely snapshot of the diverse approaches to design and a picture of the transition that this discipline has been experiencing. It offers extensive information and cutting-edge ideas for understanding the kind of service that design is currently providing and will be able to provide to the society, on a broad, transdisciplinary basis. It also features the type of ecosystem innovation design is fostering, taking into account the four key areas of the transition design framework: transition vision, theories of change, mindset and posture, and new ways of designing [3].

In time of crisis, such as the present one, design can offer important answer to societal challenges imposed by complex and ambiguous phenomena, such as climate change, resource depletion, instability due to wars and massive migrations, and pandemics, among others. The ubiquitous presence of digital and multimedia contents, the sensible role that communication and the creation and dissemination

of narratives has in contemporary societies, the needs of improved and inclusive interfaces for human–machine interaction, as well as the growing importance of concepts such as visualization and representation, may benefit both from a stronger participation of designers, and awareness of design concepts, in different disciplinary fields (software development, urban development, education, and so on).

The main research directions in design and digital communication are reflected by the organization of this book into five thematic parts, namely:

1. User-centered digital design;
2. Research methods and strategies;
3. Pedagogy, society, and design practice;
4. Digital design branding; and
5. From design history to its transdisciplinarity.

In all of them, theory and practice are inextricably intertwined.

This book gathers original contributions written by renowned researchers and professionals. They consist of revised and extended contributions to the 5th International Conference on Digital Design and Communication (Digicom 2021), held in November 4–6, 2021, in Barcelos, Portugal. It also includes additional chapters by important international researchers who were invited to present the most relevant outcomes of their current research projects. The chapters were subjected to a rigorous evaluation by both the editors and the scientific committee of Digicom. They address and seek to inspire both researchers and practitioners in the broad field of design and communication, by covering the following main topics:

- Challenges of digital interaction and communication;
- Between the utility and the dilemmas of digital design applications;
- Design for digital literacy and social inclusion;
- Design and digital communication in times of crisis;
- Information design toward design activism;
- Designing visual identities and branding given the vicissitudes of hypermodernity;
- Designing cultural heritage in the face of digital transformations.

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From Design History to Its Transdisciplinarity

User-Centered Digital Design

Interfaces, Data and Plural Languages to Develop CoDE: A Collaborative Platform for Multidisciplinary Teams

Michela Carlomagno [ORCID]

Abstract The essay aims to investigate the contemporary communicative languages introduced by the design culture for the development of digital platforms and interfaces. The research starts by analysing the state of the art regarding the creation of digital networks and the increasing diffusion of alternative means of communication, which is facilitated by the use of digital media and online tools able to amplify the geographical limits of relationships. Nowadays, collaborative digital tools and platforms are assuming an essential role in the dissemination of knowledge and information, through the creation of digital archives and databases; as facilitators of relationships for remote collaboration, through the definition of workspaces, to be used asynchronously and synchronously, with the consequent reduction of spatial and temporal boundaries. This diffusion has led visual communication design to explore and define alternative languages, made up of codes and visual synthesis, to design complex visualisations and facilitate communication within digital spaces. Starting from these considerations, the research defines a collaborative platform denominated CoDE that aims to facilitate interaction within multidisciplinary groups. The final part of the paper illustrates the GUI and UX elements of the platform and identifies their potential and future developments.

Keywords Digital platform · User interface · Collaborative design

1 Introduction

In the current digital era, the Internet is not only a space for interaction and sharing of data, information and documents, but also a "tool for connecting people, thoughts, contexts and spaces beyond the sense of place" [1]. We are witnessing an extension where relationships are free from the traditional constraints of time and space and in which it is not necessary to share the moment of interaction. There is "the union

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of the social experience of our real-life with cyber-space, thus creating a new hybrid social space" [2, p. 16].

The World Wide Web and Information and Communication Technologies (ICT) have contributed to this radical transformation of interpersonal relations and ways in which people communicate, also accentuated by behavioural changes and new lifestyles adopted in the Covid-19 pandemic.

The ways of working and studying remotely have changed physical spaces configuration but also the work modalities and tools, able to satisfy new needs and specific purposes compared to the traditional ones. Online activities have grown significantly with the spread of smart-working and e-learning models used by many companies, enterprises and institutions. Networked connectivity and workspaces evolution have also influenced the design and the way designers interact and collaborate with stakeholders, users and communities. In Design fields, the widespread multidisciplinary, interdisciplinary and transdisciplinary approaches [3, 4] have involved an increasing number of disciplines and stakeholders within the project, giving rise to new needs such as the sharing of languages, the equal collaboration between actors involved, avoiding role imbalances during the project phases and actively involving all parties involved. Therefore, traditional tools, used during design activities, such as cards, toolkits, games and physical objects, are replaced by digital platforms that connect people at a distance and record information, by offering personalized functionalities for the design and management of teamwork activities.

Digital spaces become actual places where connect, interact and exchange knowledge but also spaces for accessing data and content, mediated by the spread of digital interfaces and platforms. In these spaces, collaborative whiteboards and dashboards are intended as places to work and share tasks and information, organise files and resources, and design using templates, post-its and mindmaps. On the one hand, this promotes the possibility to establish global connections between people, stakeholders and whole communities, by transferring large amounts of data and making network communication effective. On the other hand, the risk of information overload and incorrect data manipulation affects the ability to interact within the project team, generating misunderstandings and gaps between stakeholders involved.

The chapter presents the first results of a doctoral research that starts with the study of the evolution of interfaces as virtual spaces of interaction and the selection of digital platforms used both as workspaces and tools to design and share ideas and as places to collect data and information to be transferred immediately through the construction of complex narrations and visual synthesis. The analysis of the strengths and weaknesses of the platforms and the identification of the needs of inter- multi-transdisciplinary teams at work have led to the definition of the digital tool parameters and functionalities, described in the last paragraph of the essay.

The digital tool consists of a platform able to support the collaboration of teams composed of heterogeneous disciplines and skills, by creating a common language, identifying competence gaps, tracking activities and deadlines, and constantly visualising information flows and ideas.

2 The Evolution of Interfaces as Virtual Spaces of Interaction

The evolution of *information forms* and the necessity to create new relations between user and computer have allowed Design to experiment with new user experiences and to define new ways of using contents and interaction spaces through the definition of interfaces. Currently, fields close to Interaction Design and Human–computer Interaction (HCI), such as User Experience Design [5], Service Design and Information Design, experiment with interfaces and new experiences able to involve and generate digital networks, that are places of access, exchange and comparison.

In these areas, visual communication tools, such as infographics and graphic visualisations, take the role of storytellers and make the information explicit in visual syntheses that facilitate data access and decoding, and support the transfer of content within digital platforms. As defined by [6, p. 5] "Information Visualization is the use of computer-supported, interactive, visual representations of abstract data to amplify cognition".

The development of interfaces and platforms combine aspects that concern the user (such as predispositions, expectations, needs, behaviours) with the features of the designed system (usability, purpose, adaptability, functionality) and the cyberspace (or environment) in which the interaction takes place to define new interactions with products and services.

In contemporary society, physical and digital spaces are linked to create "cognitive communities"—that is communities that dialogue and collaborate on a project through the digital network in which temporary goals and ideas are shared. Indeed, communication and interaction modalities between people are changed, mediated by screens and digital devices. Communication becomes electronic and the language "electrified" [7], capable of transferring information flows and therefore cognitive content within the new media. In this context of hyper-connection, the use of wearable devices such as watches, glasses and clothing, is transforming also the ability of interfaces to react to external factors and human input through voice, gesture and haptic controls, creating a link to the physical dimension and sometimes overlapping it.

The spread of ICT and new media have contributed to shape these changes, leading to the current software society [8]—driven by technological progress and "connective thinking". Digital space is no longer just a space of vision and action, but a space of interaction with information and remotely connected individuals [7, 9]. Interfaces become a medium in which news, stories, knowledge and thus culture can be transferred [10, 11]. As [12] states, "digital interfaces assume the role of translating and processing cultural products into bits and then returning them in understandable forms to humans, according to shared cognitive schemas" [13]. This has also influenced the definition of digital networks of experts, where products and services are defined by the collaboration of different actors who actively participate in the definition of the project.

Consequently, the interface has become a mediator not only between human–computer and human-platform but also as a process of communication between people and of monitoring the different activities. This has shifted the design focus from how users interact with objects, to the use of new visual languages inside the Web to transfer messages and contents. In this paradigm shift, interface as mediator become a technique for thought: an "allegorical device" that makes the social world accessible in an age of information, through levels or layers. As [14] claims "an interface is not a thing, an interface is always an effect. It is always a process or a translation" (p. 33).

3   Plural Languages for the Infographic Project

In the contemporary *infosphere* [15], communication inside media becomes interactive, allowing the transfer of information through interfaces that facilitate cross-media exchange. We are moving towards a "simulation, or interface, culture" that interacts with IT tools to explore virtual worlds, through manipulation and rewriting of iconic text, shaped on the screen according to our mental connections. New media and information systems, in general, enable this manipulation and transcoding of information transforming data into digital open, accessible and modifiable languages [12].

The electronic screen is intended as an extension of the human mind, where the linguistic and cultural forms of new media become the result of a merging of the computer logic and the cultural level of media content. In this scenario, communication design can translate comparisons and dialogues into design opportunities, make new scenarios visible, help to address common challenges, act sustainably and identify complex action strategies.

Graphic symbols and visual representations facilitate access to information through diagrams, maps, pictograms, icons and templates for the development of the interfaces. The use of grids and layouts allows information to be hierarchized, make it readable and accessible to others by creating visual, textual and verbal languages.

Visual syntheses within the platforms facilitate the exploration and definition of new forms of sharing, driven by open processes and the ability and desire to explore ideas and design proposals, investigate, experiment and consider multiple perspectives and potential solutions to create complex visualisations. Interfaces have become a means of connecting different actors, mediators with which we can explore alternative worlds and use information dynamically and interactively using narrations, and places in which to collect data and decode them openly. Even the design project is no longer the result of the individual action but that of a group of stakeholders with different skills, approaches and jargon adopted during the various phases of design process. The digital space becomes the place where synthesise these differences and experiment with new ways of collaboration and participation.

The cultural sites where the digital and the physical meet is also the key subject of *info-aesthetics*. But rather than think only in terms of convergence, as a cultural historian of

the present I am also thinking about other relationships: those of conflict, contradiction, borrowing, hybridization, remix. [16, p. 8]

4 New Needs and Narrative Artifacts in the Digital Era

Digital tools and services, which have emerged in the last 10 years, have facilitated the need to dialogue and share information at a distance, communicate immediately, collaborate in the creation of project proposals in a visual way and participate constantly in the creative process through shared spaces, diagrams and maps for the visualisation of contents and ideas [17].

Digitisation, open access and the consequent possibility of using large quantities of data have facilitated the dissemination and experimentation of tools for reading and decoding information. These tools are based on self-organized systems and the creation and transfer of common knowledge by carrying out co-design, co-creation and participatory design approaches.

The necessity to transmit and share content and knowledge has produced a series of communicative artefacts, including virtual ones, static or dynamic/interactive, to which the use and access to contents are associated, through new forms of narration and visualization such as digital storytelling, data storytelling or data visualization.

Numerous researchers from Tufte to Cairo have questioned how to shape data, starting from the stages of collection, analysis and visualisation to the identification of techniques to communicate in a clear, reliable and understandable way [18–20]. As Giorgia Lupi states: "In its second wave, data visualization will inevitably be all about personalization. The more ubiquitous data becomes, the more we need to experiment with how to make it unique, contextual, intimate. The way we visualize it is crucial because it is the key to translating numbers into what they really stand for: knowledge, behaviors, people." [21].

Indeed, new data-driven applications require the interaction of the user/reader, involving and helping them to understand the content communicated in a personalised way. Reference [18] in "The Functional Art" focuses not only on the purely aesthetic aspect of visualisations but also highlights the need to achieve an aesthetic that serves the purpose. A "functional beauty" that aims to make a visual representation not only attractive but able to influence the way the user perceives and explores data.

Beauty and functionality are interconnected, or should be. Beautiful and intriguing objects improve our mood and predispose us to be patient when it comes time to learn how to use them. [18, p. 92]

Data visualisation design, over time, has inspired new forms of narrations, changing the storytelling and the reading of contents through participatory and open methods for collecting and visualising digital information. New spaces of investigation and access are being experienced, as well as operational tools such as storytelling and interactive platforms, which support the reading of information, making it accessible to a large number of people. Storytelling [22] is used to give a form and meaning to intangible elements such as the bits that compose data, transforming them into

information and thus into knowledge. In particular, the construction of codes, visual artefacts and languages, and alternative usability formats, such as graphic visualisations, which permit the reading of information, help to make the content usable and readable [23] within the platform.

In the last 10 years, the spread of digital collaboration tools such as *Miro, Milanote*,[1] *Slack*,[2] *and Figma*,[3] have allowed people to work remotely, share ideas and project proposals through platforms, facilitation tools and visual synthesis [24]. Other interactive platforms have used digital visualization and storytelling, guided by codes and pictograms, to display stories and large amounts of data synthetically. These tools aim to facilitate interaction and information by making it amplifiable and interactive and to immerse the user in digital experiences.

Platforms such as "The Shape of Dreams", designed by Federica Fragapane and "Publishing Penisula Talks" made by Accurat Studio, allow users to explore stories/information through a multi-level navigation system, guided by graphic elements and visual codes. "Rebound" by the MIT Senseable City Lab and "Atlas of Emotion", on the other hand, make it possible to read databases through the use of filters, legends and interactive maps that simplify information management.

These examples of platforms have in common the use of multilevel visualisations and graphical forms of communication such as data visualization and data storytelling, that allow not only to explore and read information but also to involve and simplify the processes of data gathering and storage using diagrams, texts, animations and colours. All these elements contribute to the creation of languages and forms of visual representation that make the user experience in digital platforms customisable. Shared modalities of usage are experienced to translate inputs from different contexts into diagram-based visual models [25] that facilitate the creation of connections and enable collective planning, through "bridge-artefacts" [23] that help build visual languages. "Bridge-artefacts" are visual languages useful "to connect different points of view, local contingencies and multiple interests, structural features of a complex social system (…) for the representation of smooth and complex spaces, spaces of knowledge and controversy." [23, p. 4]. Graphs, or charts, used in visualizations take on different configurations according to objectives and visual characteristics, such as bar charts, diagrams, histograms, radar charts or word-clouds useful for comparing data, visualizing temporal sequences, categorizing and classifying information or correlating multiple elements by highlighting relationships and hierarchies [26].

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[1] *Miro* and *Milanote* are digital workspaces in which is possible to share the workspace visually to design asynchronous or real-time and personalize the creative process with templates. For more information visit the link https://miro.com/ and https://milanote.com/.

[2] *Slack* is a project management tools, in which teams can communicate and collaborate in a virtual space working remotely, managing and organizing activities by timeline. For more information visit the link https://slack.com/intl/it-it/.

[3] *Figma*, is a collaborative whiteboards in which visual collaboration allows teams to design together by translating the design process into a real project through sketches and animated prototypes. For more information visit the link https://www.figma.com/.

5 Development of the Collaborative Digital Platform: Parameters, Functionalities and Languages

The project presented starts from the definition of the background up to field research composed of one-to-one interviews and online surveys, which allowed to recognise tools, approaches and behaviours used by actors involved in multidisciplinary teams and identify common needs and issues such as the necessity to adopt a common language, to share information constantly and to update and personalize the design process according to the issue. In particular, the analysis of the weaknesses and opportunities of the mediation tools has allowed defining parameters and functionalities to develop a digital tool able to support the collaboration within groups composed of different stakeholders and from various contexts and to reduce the spatial and temporal boundaries.

The use of visual communication forms such as storytelling, diagrams and graphical elements contributed to the configuration of the Graphical User Interface (GUI). The aspects required for the elaboration of the interface are usability, clarity of information, accessibility, simplicity and user-friendliness. The GUI is developed by combining visual elements—colours, graphical signs, pictograms and charts—and textual content lists, thematic clusters of words, keywords—which define the graphical appearance and functions through buttons, drop-down lists, navigation and search areas and charts. Diagrams allow the exploration of information interactively and are part of the design of the graphical interface. The use of simple shapes, outlines and pictograms allows information to be read and conveyed and enables immediate interaction, harmonising language differences [27] and promoting constant interaction.

From these premises, the research focused on digital tool development, able to support collaboration within multidisciplinary groups, facilitating the sharing of languages, project proposals and ideas and establishing equal interaction. The platform named CoDE (Collaborative Design Ecosystem) is an open digital space that aims to facilitate interaction and knowledge transfer. It consists of an open and collaborative platform that guides multidisciplinary groups in the team-building phases, the organization of project activities, the construction of a common language, and the visualization of the archetypes that will guide to the final solutions. It is realized according to a design process that starts from the definition of functionalities, the collection of information in a database up to developing diagrammatic systems that facilitate constant access to the team's information and simplify the collaboration between parties. The process is organised and divided into 5 phases:

1. identification of parameters, characteristics and functionalities, starting from the background analysis and the data collection activity;
2. building of the database carried out through a process of analysis and coding;
3. definition of the Graphical User Interface (GUI), starting from the identification of visual languages, codes and diagrams able to facilitate interaction;
4. digitisation of the functionalities and definition of the platform prototype;

5. testing of the interface effectiveness and criticalities through a pilot study with
    the reference target.

The parameters defined for the development of the tool's functionalities are: visu-
alisation, customisation, sharing and variability, in order to support collaborative,
visual, dynamic and interactive design.

Visualization is the parameter capable of showing inputs of information in graph-
ical diagrams, from the visualization of the team composition to the identification of
the skills involved and gaps useful with the aim to optimize the team. The elements
related to this parameter are determined according to disciplines, project fields and
themes placed in the database.

Customization is the parameter that can configure graphic diagrams, maps and
work timelines on varying inputs, to implement teams with new skills during the
project development. The elements related to this parameter are determined according
to the choices of the team members concerning the contents of the tool.

Variability is the parameter that makes the information editable by the team and
consequently set the graphical visualizations related to the tool functionalities. The
elements related to this parameter are determined according to the codes and data
entered in the database.

Sharing is the parameter that builds a repository of elements on which the team
finds feedback and approves, contents, forms, references, results and timing. The
elements related to this parameter are based on information entered in the platform
that flows into an open and implementable archive.

The four parameters guide the flowchart design, organizing the layout of the
platform and its contents, through the subdivision of layers of information and visu-
alizations that respond to the features and contents organized in the database. The
platform layout is illustrated through the description of the main interface pages (see
Figs. 1 and 2).

The first window of the homepage, is the introductive section of registration
and access to information, with tabs for sign-in and log-in and user/team profile
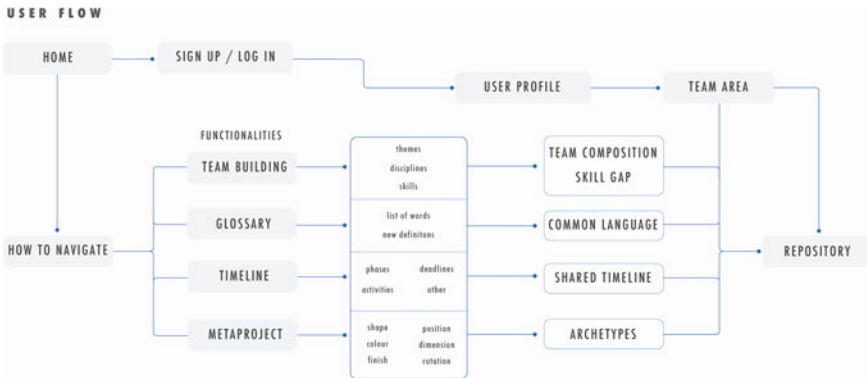
Fig. 1 User flow and UX elements definition for the platform development
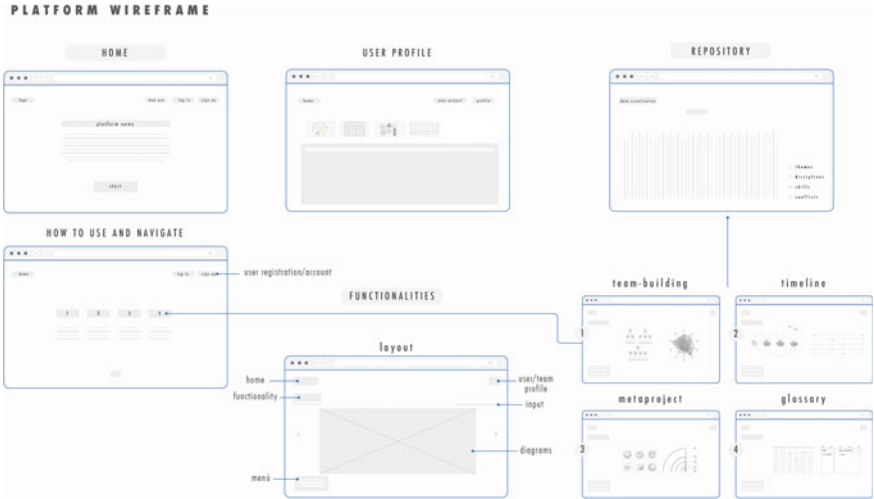
Fig. 2 Platform wireframe with the homepage, the user profile, how-to-navigate section and the four functionalities layout

management. Moreover, in the first pages is possible to explore the instructions (how to navigate), understand the purpose of each function and start the collaboration work (see Fig. 3). The opening windows facilitate the visualization and consultation of information, in synchronous or asynchronous mode, by all members of the group. The next sections are related to the navigation of four functionalities: team-building, timeline, glossary and meta-project, described in detail below. All features are linked to the home page and to the user profile section where all the information selected during the navigation are recorded. The four main functionalities are connected to the categories of elements and information to be selected by all team members.

5.1 Team-Building

The team-building represents the first functionality, able to support the composition of the multidisciplinary working group by suggesting the skills needed in the design process, distinguished by areas and themes and to detect any skills gaps related to the disciplines involved and those to be included in the team. It includes the identification of the themes, disciplines and skills involved in the team, to visualize the competence layers and identify a wider reference skill set for the team construction.

It consists of a section in which to build the team, through the choice of themes, disciplines and skills involved. The layout of the navigation menu, located at the bottom left, indicates the paths to access the three subcategories—themes, disciplines, skills and the next function. The information entered into the platform is collected in the reference database and is displayed, within the tabs, in synthetic

Fig. 3 Platform windows with the homepage, the registration section, the user profile and the four functionalities: team-building, timeline, glossary and meta-project

diagrams that facilitate the choice and selection by the user. This section enables the first phase of synergistic and equal collaboration, offering the possibility to visualize and identify any gaps in disciplines and skills within the multidisciplinary team, through the use of screens and systems of overlays and interactive visualization menus (see Fig. 4).
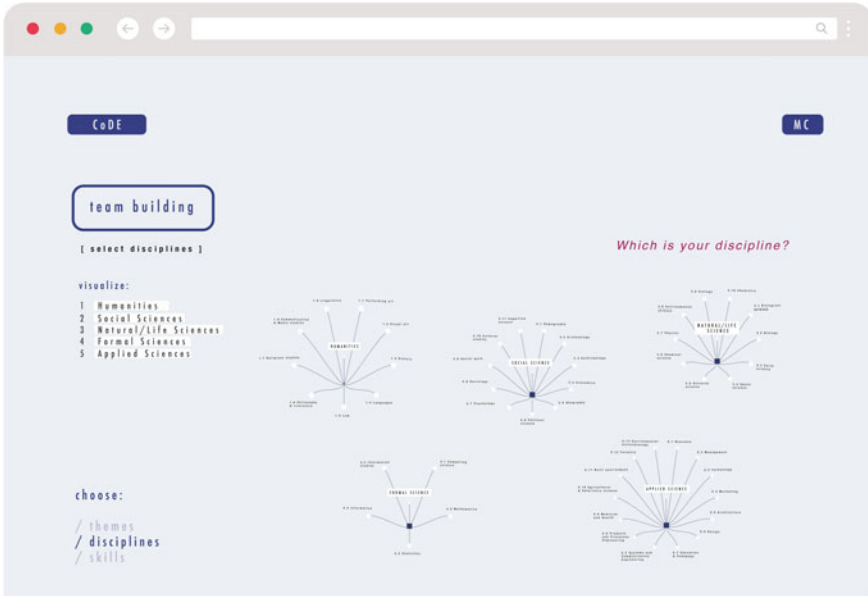
Fig. 4 Teambuilding functionality with the selection of themes, disciplines and skills of the team

5.2 Glossary

The glossary supports the construction of a common vocabulary through a lexical database implementable with definitions related to words, concepts, and technical terms most used by the different actors of the team during the project process. It consists of the construction of a glossary useful for sharing a common language within teams, through implementable definitions. It represents the space in which to consult the definitions identified in the reference database and aims to facilitate the sharing of a common language.

For this function, a second section dedicated to the implementation of the glossary (add new definition) has been prepared. A space in which to identify new technical terms and definitions that characterize the different disciplines involved in the team and that can create misunderstandings in their use, for the divergence of meanings they assume in different areas and disciplinary contexts (see Fig. 5).

5.3 Timeline

The timeline functionality facilitates the definition of the sequence of process phases, agreeing on the expected results for each step, roles and deadlines. Moreover, it allows for the management of objectives, the visualization and planning of activities of all
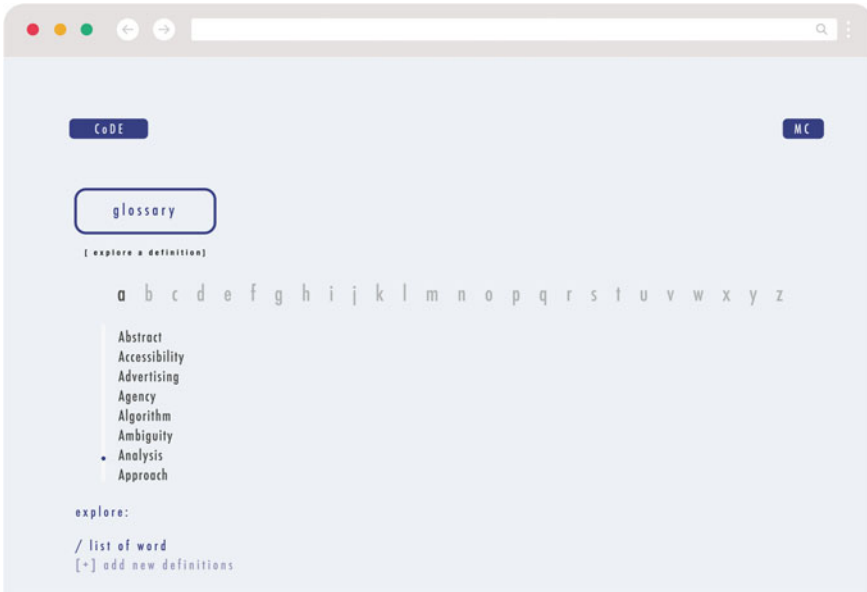
Fig. 5 Glossary functionality with the list of words and the section to add new definitions

team members. It consists of the set-up of a space dedicated to the organization of work phases, activities and deadlines guided by a code characterized by pictograms that allow the construction and customization of a chronological sequence related to the project. The purpose of this functionality is to organize the project process, identify activities, phases and deadlines, by generating a calendar of meetings and visualize the level of interaction of the actors involved and how the disciplines intervene in the work phases.

It is composed of a timeline and a series of pictograms differentiated by shape and colour that lead to the customization of your process by identifying and calendaring—phases, activities, deadlines or meetings and others—in order to organize and track the activities of the team and share term and goals for projects realization (see Fig. 6).

5.4 Meta-Project

The meta-project functionality drives to visualize ideas through shapes, modifiable through algorithms, and lets aggregate elements to synthetically represent ideas during all the creative process phases. It is a system of shapes, colours and elements guided by parameters and algorithms that allow the composition of elements, useful for the visualization of the proposals in the meta-project. An abacus of forms and codes, accessible to all team members, which allows the construction and sharing of

Fig. 6 Timeline functionality with the timeline to personalize with phases, activities, deadlines and others

archetypes. This functionality represents a virtual interaction space, useful to stimulate the ideation phase in the teamwork and support the conceptualization of the project idea to visually synthesize the purposes that emerged in the analytical phase.

This section is composed of the predisposition of basic shapes divided in solid, outline and intersection and by inputs and parametric variables such as shape, colour, dimension, surface finish, rotation and position on the plane. The parametric code is defined in Grasshopper, a language and visual programming environment that runs within the Rhinoceros 3D CAD software. The algorithm allows the overlapping and the configuration of the different basic elements between them, translating the creative process in a shared visualization of geometric shapes, determined by the interaction between user and digital tool and by the relationship between shapes and codes that generate a representative archetype of each team member (see Fig. 7).

The interface allows users, members of the team, to interact collaboratively and immediately, at the same time, collects and classify data in a repository to make information available to other groups and allowed to explore them on multiple levels. Following the graphic definition of the platform screens, a first interactive digital prototype was defined and tested on focus groups with samples similar to the target audience to verify the clarity of the graphic interface, the functionalities and to implement the user experience and flow.

Fig. 7 Meta-project functionality with the exploration of shapes and the composition of digital archetypes

6   Conclusions and Future Steps

The aspects investigated in this article are some of the possibilities offered today by the digital platforms for the management of systems of relationships generated by the collaboration between different actors and how these systems are influenced by external factors. The use of communicative codes and graphical synthesis in digital spaces allows spreading of information and knowledge, adopting interactive, visual and multilevel languages able to involve people.

The platform intends to experiment with a new model of multidisciplinary collaboration able to reduce the disparities that are generated within the teams, through the use of communication codes, and visual synthesis that allows a constant exchange and interaction between the actors involved.

The realization of digital space, flexible and open, able to record inputs allowed to define a model of collaboration and active participation in the project, through customizable and interactive features and to facilitate the exchange of knowledge and languages through an implementable repository. CoDE help to track activities, visualize skills and have constant access to the team information, by facilitating the management of phases and activities, activating a continuous comparison and participation of different actors through interaction and experimentation of visual codes.

The graphical user interface of the platform was tested in several focus group sessions, each composed of 3–4 participants, to test the user flow, functionalities and graphical elements of the platform by using the "Think aloud protocol" on the interactive prototype defined in Adobe Xd software. This led to the collection of initial feedback and improvement of the graphic interface layout and user flow. In the near future, further tests with new samples will be carried out to implement the GUI and to analyze new needs for the definition of new functionalities for the platform CoDE. The experimentation with multidisciplinary, interdisciplinary and transdisciplinary groups at work during the creative process will allow the identification of other factors which hinder remote collaboration, misunderstandings and conflicts negatively affecting the success of projects. The final step is the creation of the website to launch the tool online and implement the platform database with new information and data.

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Scratch-Based Game Development Resource Set for a Toolkit to Game Design

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Abstract Games are engaging activities for students that can be applied in classes worldwide. Simultaneously, toolkit's potential has been rising over the years due to its ability to encompass relevant tools on specific subjects. Moreover, toolkits can be applied as authoring tools transforming students into game designers, motivating the creation of digital and/or mobile games, and knowledge acquisition and engagement. The Gamers4Nature (G4N) project has been researching on environmental-themed games' development, involving students in game development sessions. Aiming to support the whole game design process for upper-secondary and undergraduate education, the G4N project conceived a Toolkit to Game Design that has been used in formal and informal contexts of education fostering the creation of digital games on environmental themes. The G4N Toolkit, addressing both experienced and novice students, was design in a User-Centered approach with iterative sessions for validating aesthetics and contents. As it was understood that students sometimes lacked the skills to develop their games, preventing them to accomplish a finished product, a complement to the already produced resources (Game Construction cards, Rapid Game Design Document, environmental-themed cards, and Mobile Game Design Guidelines), was developed: the Development Cards Set. This chapter introduces the Development Cards Set creation process, to be validated through expert review (by experts in the game development field) and by end-users who will test and validate the development cards along dedicated workshops and game creation sessions.

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1 Introduction

Games are an important part of human existence, with the human's interaction with games being found in various fields, from leisure activities to education [1]. In the Education field, games have the potential to be used as a teaching strategy, either by recurring to game-based learning approaches [2], or by engaging students in game-creation activities—an approach that also allows them to develop specific programming knowledge and skills [3, 4]. The creation of games, however, requires a specific set of competencies and skills that sometimes may not-existe or be underdeveloped, specially with younger audiences. In this scenario, the non-linearity that—sometimes—pertains the game design process may push prospective creators away, forfeiting the chance to nurture from non-experience users' involvement.

In the field of game design, toolkits, namely authoring toolkits, can support students to create artifacts by integrating the necessary tool for them to develop a determine activity [5, 6].

In this scenario, and aiming to engage upper-secondary and undergraduate students in active participation in game creation activities, the Gamers4Nature (G4N) project, developed and validated a Toolkit to Game Design [7–10] that aims to provide, in a single component, the necessary tools to allow any student to create a full gaming experience: from the game narrative definition to its coding implementation. The G4N Toolkit addresses the several dimensions of game design: (1) the game narrative is supported by the game construction cards set—that provide information about the different elements that compose a game—by the rapid game design document—that suggests a path to explore and articulate the game construction cards–, and by sets of thematic cards, that present information about specific environmental-related themes and thus allows students to grow their knowledge and awareness on the environmental field whilst creating games [3, 4]; (2) the game aesthetics, with a set of mobile game design guidelines that provide support in the design and aesthetics of a game considering literature and industry best practices [10] and finally, (3) the game implementation/coding, with a set of cards that aids the implementation process of a game, not only by suggesting an intuitive platform for (non-)experienced programmers but also by tutoring (i.e. step by step) that platform's usage in the context of game development.

In this chapter, we present the game implementation cards development process, from the theoretical background that supported its creation to its prototyping and validation process. Furthermore, we introduce the theoretical background that supported the Development Cards Set creation process as well as the methodological approach to be taken to validate through expert review (by experts in the game development field) and by end-users who will test and validate the development cards along dedicated workshops and game creation sessions is also introduced.

2　Theoretical Background

2.1　*Games: How Can We Define Them?*

Games and play can be adjacent concepts, and indeed complexly related, they are distinct: games can be board games, card games, sports, computer games, among others; play can be either an activity involving games, or subset within the game design field [11].

Games, as a fundamental part of human existence, are a complete and self-sufficient "formal system that subjectively represents a subset of reality" [12, p. 8]: formal since it has rules and a system due its parts that interact between themselves. They can also be defined, in a more ludic or "ludological" approach, as a goal-directed and competitive activity conducted within a framework of agreed rules [13].

According to some authors [14], games can create habits, sustain changes, and indicate civilization's preferences, weaknesses, and characteristics, hence games have the potential to—applied in diverse approaches—promote knowledge development and/or behavior change. In fact, students can benefit from their involvement in games' development process [15]. Despite minor variances in game's definition, there is a consensus that games consist of components within a framework of rules [16].

2.2　*Creating Games: Is There a Process?*

Artifacts derive as a product of a design methodology that guides the creative process and ensures the artifact's quality [17]. Games, as artifacts, are created from scratch [11], nonetheless, there is no fixed design process (only best practices [18]), in fact, new approaches may lead to innovative designs. Nevertheless, we should never overlook some game design basics, such as game mechanics and materials, and a theme [11].

In a more general approach, a game—to be created—needs to be conceptualized, written, built, and examined, consisting of the decision on what the game should be (e.g. design, rules, mechanics, scenarios, setbacks) by defining each of the game's elements [18]. Notwithstanding, diverse authors consider different approaches to this process: while Werbach & Hunter follow the Mechanics, Dynamics, Aesthetics (MDA) framework [19], Fullerton uses game elements to build a game, and Duke depicts a process of nine steps [18]. These diverse approaches to game design emphasize that this process can be rethought according to the applied strategy to foster game implementation and the target audience that is going to be the game designer.

There are some resemblances between game design process approaches: a conceptualization concerning the dimensions of the game narrative (e.g. what is the game

about, the theme, what and how to achieve), the game aesthetics (e.g. visual appearance, graphical content), and the implementation as in making the game work [15, 17, 18].

2.3   Toolkits to Support the Game Creation Process

Purely theoretical education is proven not to be enough to teach in any design education field, as learners indeed need to be involved in more practical experiences in order to achieve and acquire knowledge regarding design processes [11]: in fact, and when engaged in game design training courses, students must create games.

Having this into consideration, toolkits may have the potential to involve students in design processes: on the one hand, due to their capacity of facilitating activities [20], on the other hand because they are suitable for novice and experienced users, and enhance creativity [5, 9].

Practical teaching in games, without disregard to its contiguity with computer games, does not necessarily require game programming classes and exercises [11]. Therefore, besides the digital games rising, initiatives to develop games should not be narrowed to digital approaches. Authoring toolkits have huge potential to users since they are placed as creators and designers whilst nurturing and grasping the advantages of having the required tools to execute a process, fulfilling its goals.

Toolkits have the ability to transpose abstract and complex concepts into practical and clear definitions that may allow students to operationalize those abstractions into concrete games [21]. Concerning games, there are multiple examples of toolkits or card approaches to game ideation/brainstorming, narrative, and implementation. As for game ideation: the Grow-A-Game cards uses conscious design and analysis of digital games[22]; GameSeekers is played similar to UNO and uses cards in a collaborative game to visually build a game idea likewise in a mindmapping process [23]. Regarding game narrative: through a book, (even non-experienced) game designers are able to access a stepwise game development process [24, 25]. Finally, for game implementation: digital songlines game engine toolkit supports the development of Australian Indigenous storytelling in a sensitive manner by creating virtual cultural landscapes in 3D game environment [26]; practical instruction on creating world-class games that will be played repeatedly with over 100 lenses of fundamental principles of game design [27].

3   Supporting the Game Creation Process: The Gamers4Nature Toolkit to Game Design

The Gamers4Nature (G4N) project aims to promote students' engagement with environmental themes (e.g. microplastics, invasive species), hence fostering knowledge

on climate preservation and the earth's biodiversity by encouraging their participation in the development of environmental mobile games [7]. Since 2017, this project has been working with upper-secondary and undergraduate students through a series of workshops and game creation events, motivating them to create their own digital games in game jam sessions and events.

In order to incite students' participation, whilst nurturing collaboration and engagement between peers and with the educational subjects, the G4N project has implemented several strategies to support the game creation process. One of those strategies consists of a toolkit to support the whole process of game creation, from game narrative to game implementation, to be used even by novice users—those with no previous experience in game design or game development. The G4N Toolkit to Game Design (Fig. 1) comprises several resources: a game construction cards set with 12 cards approaching an adapted version of Fullerton's game elements [8, 18]; a rapid game design document presenting a path to explore the game creation cards and building the game narrative; sets of thematic cards addressing nature and environment preservation (e.g. microplastics, stag beetle, dune systems); and a Mobile Game Design Guidelines cards set [10] that aims to help users when creating the game interface.

As the G4N Toolkit intends to be used even by novice users—those with no previous experience in game design or game development–, and as there was a purpose to create a comprehensive resource that would support users all along the digital game creation process, from narrative to implementation, a new set of cards— the Scratch Development cards set was developed. With this new set of cards, the G4N Toolkit to Game Design emerges as a resource able to support the whole game design

Fig. 1 The Gamers4Nature toolkit to game design: on the left the rapid game design document; on the right, (in order) the game construction cards set, the thematic cards (the microplastics theme example), the mobile game design guidelines cards set, and the new cards set: scratch development cards

process (from narrative to implementation), along its main stages: (1) conceptualizing the game; (2) designing the game interface; and (3) implementing (coding) the game.

Along the game design sessions fostered by the G4N project, whilst students used the G4N Toolkit to create and design their games, it became visible that some students struggled when the time to implement the game arrived, stressing the need to support (also) this stage of the process.

Conceptualizing and Writing the game. Game Design is a relation between the game design/development output and the players' experience [11]. Thinking as a game designer requires a solid process from the game's initial concept to its creation to create a playable and satisfying experience [18]. For many people, the ideation stage—which can be considered the beginning of the game design process—can be an immediate barrier [18]. Furthermore, this process can be innovated, still it must concern game design basic principles, such as mechanics, materials, and themes [11]. The G4N project aims to innovatively answer this context, providing and motivating students to be designers and creators of their own games, by providing them with tools to be involved in this process consciously. To support the game's narrative construction, the G4N Toolkit encompasses three main elements: the game construction cards set, the rapid game design document, and the thematic cards. The game construction cards and the game design document can be used together, comprising cards clarifying the game's main elements and the document suggesting a path to explore and articulate the cards [4, 8]. As the intent is to create games addressing environmental awareness themes, the G4N Toolkit also provides cards set addressing several environmental-related themes. By challenging students to create games on these topics, their engagement and interest is being prompted and motivated [4]. Sessions held with upper-secondary and undergraduate students emphasize the G4N Toolkit's usefulness and value [3, 9], while the plasticity of these resources was pointed out by game design experts, who mentioned that it transmits different perspectives on game design, supports ideas' systematization and exploration, and guides the game construction [9, 10, 12].

Designing the game interface. Games are nothing more than an idea when they are limited to a narrative. Therefore, it is essential to design the game within an environment where players can experience the game narrative connected with graphics. Likewise any other field, the graphical appearance of any output constraints the overall experience with it, hence it is crucial to design a game complying with game standards, avoiding that the gamers' experience is affected by a bad design.

Along the game design sessions held with students, some barriers related with interface design were identified, hence an additional set of cards was added to the G4N Toolkit: the Mobile Game Design Guidelines Cards set [10]. Validated with experts in design and in games, the set included 28 cards approaching essential guidelines for mobile game design, from interface to interaction, performance and promotion categories. While the previous resources help to define the game narrative, the MGDG cards filled a gap on the G4N Toolkit by bridging the game narrative with the interface design implementation.

Implementing (coding) the game. Nevertheless of the Toolkit's efficiency in supporting the game design process (see [3, 4, 7–10]), to fulfil the whole game creation process students still must implement the game themselves.

Following the approach taken for the Toolkit's development—to create resources able to guide users with and without experience in game design to create digital games—a set of cards with examples and instructions on how to implement a game using programing visual languages was created. Research suggests that, amongst the several visual programming languages that can be used to create games, Scratch is one of the most used in schools and is already integrated into computer science formal and informal education in schools and universities, due to its programming teaching potential combined with its usability [28–30]. Taking this into consideration, Scratch was chosen to exemplify the coding process, due to its block-based approach, suitable for both experienced programmers and non-experienced users.

4 The Development Cards Set for Scratch

Aiming to synthesize in a single tool the ability to support the entire game creation process—from the idea to its materialization in Scratch–, the G4N research team created a new set of cards to fulfil the last step in the game creation process: developing, i.e. coding, the game.

Scratch was the software chosen due to its easy learning curve, hence supporting non-experienced students in both game design or the software itself. The block-based approach integrated in Scratch is easy to learn and self-explanatory: e.g. a student does not need to have previous teaching concerning loop events to understand that by inserting any block into the "forever" block that that event will occur indefinitely. Although there are several resources to aid Scratch's use, this cards set is pertaining since it completes the G4N Toolkit, allowing it to—in a single resource, aggregating several components—support the **entire** game design process.

This new set encompasses 29 cards divided into seven separate categories approaching different stages of the game development process. Each category groups multiple cards on similar or related topics: before starting the game; start the game; move; visual appearance; sprites and backdrops; audio; repetition and decision structures; variables and messages. The category titles were defined to be explicit and clear regarding its objectives, and also the cards' title (see Table 1) were denominated and written in a way that would be evident for even non-experienced users.

The cards were designed in a way so that they can be used separately or as a group. For example, one card explains—by itself—how to start the game, while another card depicting how to move a sprite, mentions the card to start the game, and then answers its propose. This way, users can form a sequence of cards and thus building the hole code structure for their game.

In order to be easily distinguished from the G4N Toolkit's card sets addressing game narrative, and following the same design approach taken for the development of the mobile guidelines cards, the development cards set follows a tutorial format

Table 1 Development cards
set: scratch orientations
divided into seven categories

Category	Cards title
Before starting the game	Clean game scenario
Start the game	Start the game with the scratch flag
	Start the game with broadcast of a message or word
	Start the game with a button click
Sprites and Backdrops	Create new sprite
	Insert sprite
	Create new backdrop
	Insert backdrop
	Change backdrop
Move	Move sprite with keyboard
	Move sprite automatically
	Collisions between objects
	Collision with specific color
Variables and messages	Create variable
	Show or hide variable panel
	Scoring points
	Change variable value
	Broadcast message to the whole game
Sound	Choose a sound from scratch's gallery
	Play background music throughout the whole game
	Play sound in backdrop change
Repetition and decision structures	Repeat an event forever
	Count the game's time
	Create conditions to execute events
	Logic operators: This *and* that?
	Logic operators: This *or* that?
Visual appearance	Buttons
	Animate game buttons
	Add sequential texts
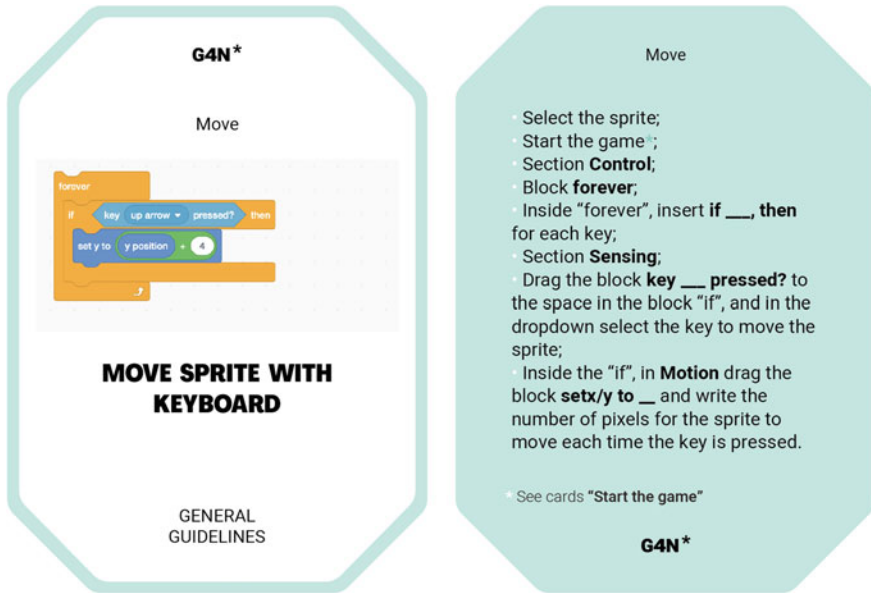
Fig. 2 "Move sprite with keyboard" card from the move category: a model of the development cards set

by integrating an image that visual represent the code block (card's front) and step by step instructions that can be read and followed to build that block (card's back). In fact, the image aids in the block's replication and the text specifies the groups where each block can be found (see Fig. 2).

The development cards set is composed by 29 cards divided into 7 categories approaching different objectives and actions of a game: before starting the game; start the game; move; visual appearance; sprites and backdrops; audio; repetition and decision structures; variables and messages.

As for the cards' layout, the card's front is composed of the G4N project's logotype, the category's title, an image with the built Scratch blocks, the card's title, and the title of the card set. In what concerns the aesthetics, the card has a border that reflects the card's content category—common to all the cards in this set-, each category having a different color, and the layout is similar to the other card sets in the G4N Toolkit. The cards' back comprises topics, each one regarding a specific step of the Scratch function's construction. Furthermore, it includes the category's title and the G4N project's logotype as well as, when needed, a reference—marked by an asterisk—to other related cards in the set.

5 Conclusions

The acknowledgment of the games' potential in formal and informal contexts has been prompting researchers to develop work in this field. Furthermore, there is a worldwide recognition concerning the capability of toolkits to aggregate useful resources, specifically for games, as well as to convey relevant information enhancing students' understanding of subjects and their motivation towards them.

In this line of thought, the Gamers4Nature project, allying two slopes—games and environmental preservation and awareness–, has developed a Toolkit to Game Design encompassing a full approach to the game design process. Throughout this development cycles, in a User-Centered approach, the project's research members have conducted iterative sessions with experts and end-users in order to evaluate the resources' aesthetics as well as the theoretical knowledge provided and the integration in real-life scenarios of these resources. From the G4N studies' empirical evidence, the project has scaffolded the need to provide support for both experienced and non-experienced students in game design field, aiding them with tools to create games—from scratch—games concerning a specific theme. Hence, in this context, by successively producing decks of cards for each step of the game design process, the project as now achieved a full version of the Toolkit, which contains: Game Construction cards, a Rapid Game Design Document, environmental thematic cards, Mobile Game Design Guidelines, and Development Cards to create games resorting to Scratch.

This project hopes that, by providing a full toolkit addressing the multiple stages of game design, can assist even non-experienced students to create their own games, whilst promoting environmental awareness. The conducted sessions, in which more than 160 students were already involved [3], shown the G4N Toolkit's potential and how one tool can support the development and creation of so many diverse results.

5.1 Future Work

Similarly to previously developed components of this Toolkit, the research team aims to validate these cards with end-users in order to execute possible required adjustments and improvements, and make available this resource to support game ideation, creation and implementation. Following the same approach taken for all the other toolkit's resources [3], this new set of cards will be validated by experts in the game development field (expert review) who are familiar with this coding language and are used to work younger audiences, and by end-users who will test and validate the development cards along dedicated workshops and game creation sessions.

Future work also includes the development and validation of other sets of Scratch cards, designed to be used in the specific creation of environmental-related games. These cards will follow the design aesthetics and approach of the introduced Development Cards.

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Preventing Wildfires from Our Phones: A Communitarian Participation Mobile App to the Portuguese Context

Manuel Gil, Liliana Gonçalves , and Lídia Oliveira

Abstract Forest fires have caused devastating social and economic damage in the forest-dependent regions of Portugal. This phenomenon can accentuate in the following years due to many factors that can aggravate conditions like extreme drought, lousy forest management, or interior depopulation. On digital platforms, forest fires are a target of investigation and analysis. The results point to a few varieties of mobile applications, most of them focused on the combat phase. The ones about prevention are limited and with little interaction. This work summarizes the Portuguese situation respecting forest fires and presents a study of the country's existing apps and prevention campaigns. Based on the analysis of interviews conducted by the orientation team, a mobile application oriented to the active participation of the community in the prevention of forest fires was conceptualized, prototyped, and tested. This app lets users add alert points and/or public actions on a map and give them space for discussion and helpful information.

Keywords Wildfires prevention · Mobile app design · Interaction design · Communication design

1 Introduction

Wildfires are a natural phenomenon that affects the Portuguese forest causing significant social and economic damage. This is a natural phenomenon exacerbated by different factors such as (1) the behavior of those who manage the forest and other factors; (2) climate change and prolonged periods of critical temperatures; (3) the

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structural profile of the Portuguese forest, mainly composed of private owners [1]; and (4) substantial depopulation of the interior [2], which is where the largest area of the national forest is concentrated.

Fire prevention is fundamental to protecting forest, communities, and their social and economic well-being, so it is essential to consider tools that contribute to knowledge about preventive practices based on the active participation of different actors in wildfires.

In today's society, digital platforms are vital communication media to broadcast relevant information and a tool to help in responding to emergencies, particularly social networks [3]. Most mobile apps about wildfires are oriented toward the combat phase, and their features may not always be useful for those mainly affected by this phenomenon [4]. The intersection of these two domains, forest fires, and their prevention carried out by digital platforms, is the main motivation of this research, whose objective is to conceptualize and develop a mobile app for the community prevention of forest fires in Portugal.

2 Methodology

Portugal is different from other European countries due to the inherent characteristics of its territory and the current management of its forest [5]. To cope with these attributes, the authors adopted applied exploratory research focused on preventing fires through digital platforms, aiming to make an innovative and beneficial contribution to the main actors affected by this phenomenon. This research approach aims to bring together the stakeholders of each region to increase their participation in forest prevention and conservation actions, thus contributing to the protection and well-being of the community.

It will be used data from different instruments. In the initial phase, it is carried out research for the theoretical framework to identify the needs of potential users. Also, it will be considered the results of interviews carried out with citizens and stakeholders from São Pedro do Sul and Pedrogão Grande (two municipalities in the Central Region of Portugal at significant risk of wildfires) and surveys with the scientific community of the central region of Portugal held by Gonçalves [6]. These sought to identify stakeholders' and community members' infocommunication needs and assess their propensity to use a digital platform oriented towards fire prevention. Thus, the data obtained through interviews and surveys of different actors in the context of wildfires was used to define the functional requirements and design the application's prototype. This prototype was later subject to usability tests by users with profiles similar to those defined in the empirical data collection.

3   Theoretical Framework

Research in wildfire prevention linked to digital platforms is still limited. However, the literature review identified Voluntary Geographic Information (VGI) as a valuable tool in disaster prevention. It allows digital platform users to share relevant data with an associated geographic context [7]. This type of information, associated with maps, can be presented on any platform and is reachable by most citizens. It can be essential in decision-making and more effective communication with other community members. Therefore, the widespread use of mobile devices provides opportunities for implementing IGV-based systems in communities and enhancing their characteristics, allowing any user to share information they consider relevant about a given event.

Haworth et al. [8] state that community participation in local decisions is fundamental for each region's proper functioning and democracy. IGV systems can be a potential contributor to maintaining this good functioning, including the prevention of forest areas and community protection. Thus, disseminating information associated with a location is considered the most appropriate way of transmitting information concerning the theme of wildfires. Another most frequent characteristic raised from this bibliographic review, which involves the community's participation, is the use of data collected by citizens or volunteers with an associated geographic context, which specialists then analyze. This kind of approach applied to the wildfire topic promotes research progress, improves forest management and the active participation of the surrounding population [9]. Hence, digital platforms can be the tool that speeds up this entire data collection process and, simultaneously, communication between the different actors in forest management.

However, some of the participants raised privacy and veracity issues regarding using the IGV [8] or concerns about collecting wrong or malicious information [9]. The case study by Nayebi et al. [4] about the fire of Fort McMurray studies this problem by comparing the functionalities of existing fire-oriented apps with the discussions on social media during the events, concluding that many of the apps did not contain beneficial functionalities that could be used during a crisis.

On the other hand, it is also essential to clarify to potential users that these systems work as an auxiliary tool that complements the prevention and management process [7]. For practical effects, each municipality must implement concrete strategies, as described in the studies by [10, 11]. Both authors analyze cases of municipalities that have implemented cross-sectional mitigation measures for the entire community, positively reducing the spread of occurrences. These, applied to a digital platform, can further increase its effectiveness and thus enhance the levels of protection of populations residing in forest areas.

4   Wildfires in Portugal

Forest fires are one of the most devastating phenomena in Portugal. The Institute for the Conservation of Nature and Forests (ICNF) released the structural hazard letter for the 2020s to 2030s in Portugal, revealing a potentially devastating scenario (Fig. 1).

It is crucial to know the causes and risk factors contributing to dangerous levels as high as those represented in the previous image.

The trend toward the worsening of extreme weather conditions is a catalyst for the occurrence of large fires [13]. The great fires of 2017 in Portugal are an example.
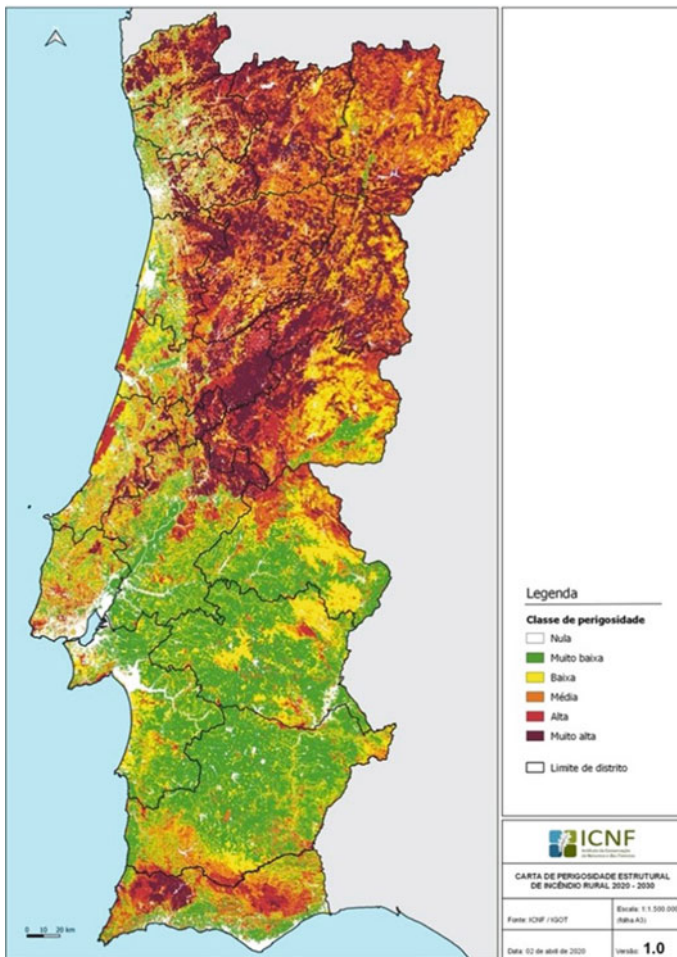
Fig. 1   Structural hazard chart 2020–2030 released by ICNF [12]

With high temperatures and extreme drought, trees are more vulnerable to diseases and pests, leading to more dead trees becoming more susceptible to fire [14].

Other aspects can be factors for a high level of risk. The structural profile of the Portuguese forest shows that only about 3% of forest land is owned by public entities, unlike in the European Union, where 40% of forests are in the hands of public entities [1]. This scenario worsens when there is a high level of property fragmentation, making efficient and coordinated forest management difficult [5].

On the other hand, another of the leading causes of fires in Portugal today is arsonism and negligent use of fire, mainly in burnings and fires and the re-ignition of other occurrences [15]. These data reveal the insufficient awareness of communities regarding forest protection, risk behaviors, and good practices.

These factors increase structural hazards and the risk of large fires, making it extremely important to adopt effective prevention measures that engage the population, authorities, municipalities, and other national territory managers.

4.1 Communication Campaigns to Prevent Wildfires in Portugal

Concerning prevention actions and fire risk mitigation strategies, which are essential for protecting communities living in regions with significant forest areas, specific prevention measures must be adopted in the Portuguese context to reduce the risk of fire more efficiently and effectively.

The analysis of the Portuguese scenario identified the need for interventions in 4 major areas, such as preventing negligent ignitions, creating networks of fuel management lanes in critical areas, implementing perimeter control tactics and fire management strategies, and restructuring the firefighting organization [5].

After these, concrete measures were developed, including communication with the communities from the outset. In this context, national and municipal awareness-raising plans included disseminating good practices, reducing risk behaviors, and, above all, increasing participation and communication between communities most affected by the fires.

This research analyzed national communication campaigns to prevent wildfires between 2017 and 2019. The goal was to understand these campaigns' informative focus, media, and target audience, focusing mainly on digital media. This data collection was necessary to recognize the method of action with the communities.

Regarding the communication campaign of 2017, in charge of ICNF, awareness-raising posters, short messages related to good practices, and guidelines for forest protection aimed at defined target audiences were identified. However, the bet on digital products was reduced. Except for advertising spots on national television and radio, the focus on other digital platforms such as smartphones and social media was short. Information in this format could be found on multiple institutions' websites, but

with unappealing approaches and without a previously defined campaign. The wild-fire prevention communication plan for 2018 remained in charge of ICNF and was quite similar to the previous year. However, content dissemination on web platforms was increased.

Nevertheless, there were no concrete implementation plans for digital media. There were only used webs from different institutions to disseminate digital content without specific wildfire prevention campaigns. In 2019, the national awareness plan was passed to the Agency for the integrated management of Rural Fires (AGIF) to promote a coordinated action between forest protection entities such as ICNF, Civil Protection, and GNR. In this awareness plan, digital platforms were more robustly adopted to support the campaign "Portugal Chama",[1] mainly on web platforms and social networks. In physical format, leaflets and posters were reused in the same style as previous campaigns.

On a digital level, it was possible to collect some of the videos referring to the advertising spots for television, using the slogan and relevant messages to prevent fires and protect forests and the communities within them.

Content dissemination on web platforms can be accessed from any online device, such as the website portugalchama.pt, or the social media of private entities that partner with AGIF to disseminate the national campaign. The portugalchama.pt website is still active today and is now one of the top online information spots regarding the "Portugal Chama" campaign. The website has an appealing visual appearance using many images and short and easy-to-interpret messages. It also has useful contacts at various points on each webpage to get more detailed information.

4.2   Mobile Apps About Wildfires

A survey of mobile apps dedicated to wildfires was conducted to understand how existing apps are used and their most common features. The research was carried out on Android and IOS operating systems on official app search engines. The keywords used in the app stores search engine were: Wildfires; Forest Fires; Fogos[2]; Incêndios[3]; Incêndios Florestais[4]; Forest Management. An international geographic scope was applied, which means Portuguese or other mobile applications were eligible. Apps in the beta phase and platforms not directly related to the topic of Forest Fires or Forest Management, such as Urban Fires or Video Games, were excluded. Only free apps were downloaded from both stores (Apple Store and Google Play). The inclusion criteria for the Android operating system were to have at least 10.000 downloads and a minimum 3.5 score, given by users on a scale from 0 to 5. These criteria did not apply to the IOS environment due to the limited number of results (Fig. 2).

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[1] This slogan can be double understood as "Portugal calls" or "Portugal flames" in Portuguese.

[2] Portuguese word to "fires".

[3] Portuguese word to "fires".

[4] Portuguese expression to "wildfires".
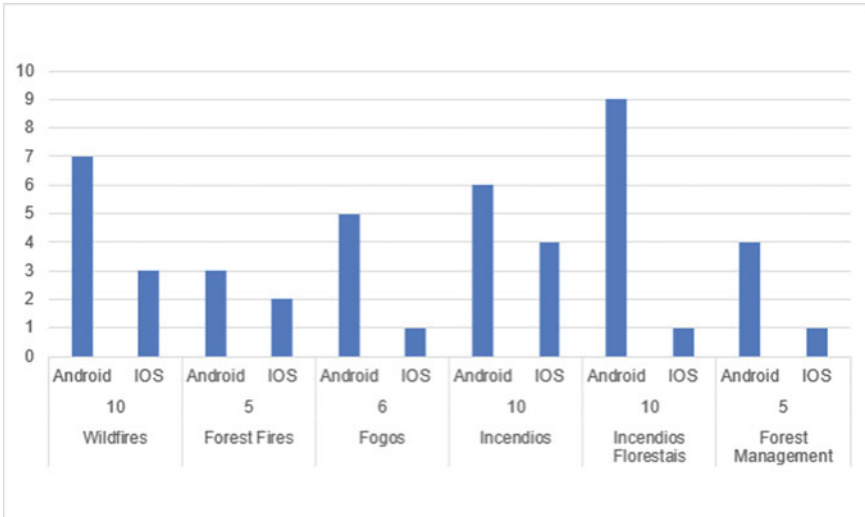
Fig. 2 Number of apps found for each keyword in different operating systems

Twenty-one apps were analyzed. More results (15) were recorded in the Android environment than in the IOS environment (11). Five apps appeared in the search results on both operating systems. Five are national apps, twelve have international context, and four have regional scope. After analyzing its characteristics and features, each app was placed in a category representing its primary purpose. The following table reveals the typology of each app (Table 1).

The results demonstrate more apps in the combat typology (see Fig. 3), with features such as listing occurrences by georeferencing, information about combat means, and notifications of specific occurrences in areas defined by the user. Of the 21 apps analyzed, 11 are included in the combat typology. One has a regional scope,

Table 1 Typology of analyzed apps

Combat	Prevention	Forest management	Prevention and forest management	(1) Information/(2)Information and prevention	Simulation
– Fogos.pt[a] – Incêndios Direto – Fogos em Portugal[a] – AB wildfire – Incêndios Rurais – Firemap	– Incêndios JCYL	– Geo forest – Forest watcher – Forest manager – Die Waldapp	– Forest-IN app – Forestry	– Forest fires glossary (1) – Prociv Madeira[a] – Prociv Azores[a]	– Wildfire analyst pocket[a]

[a] Apps analyzed in both operating systems, Android and IOS
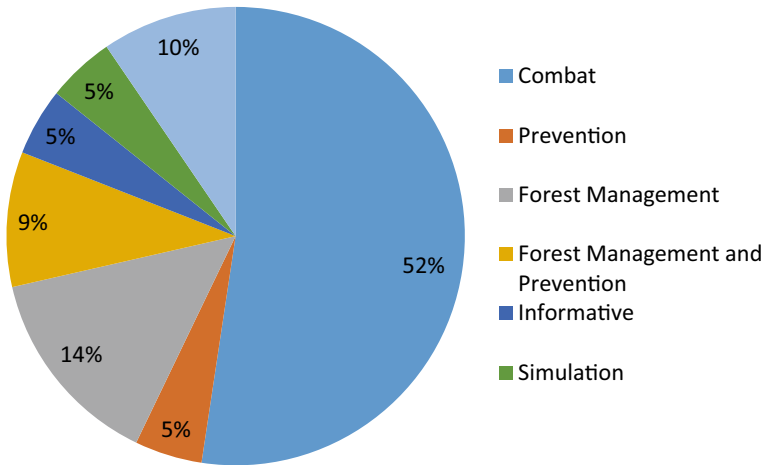
Fig. 3 Percentage of apps in each typology

five have a national context, and the rest are international. All applications analyzed in the combat typology use georeferencing to record wildfires. Five of them disclosed the combat means in the wildfires. Notifications are also a standard feature, present on several platforms and in different formats. They can vary between alerts on the status of a wildfire or alerts of events in areas selected by the user. The wildfire risk is also included in several apps in this typology, although this is considered a preventive measure. In addition to this characteristic, information on behaviors to prevent forest fires was also observed in one of the combat typology apps.

Five of the 21 apps were categorized in the prevention typology. The most frequent prevention features are disseminating risk behaviors or good practices in a textual or audiovisual format with little interactivity and without animations. Added to this category, the forest management, and information typologies also appear since short and long-term preventive actions can consider information about prevention and forest management. Both allow the adoption of strategies from an early stage to protect the forest and thus reduce the occurrences caused by negligent management.

Three applications were included exclusively in the forest management component and two in the aggregate typology of forest management and prevention. The apps included solely in the forest management typology focus on creating systems that allow the user to register forest areas that he owns to help the management of these spaces. The features of the aggregated typology included disseminating good practices in text or video formats with simple navigation menus. One of the platforms allows the evaluation of existing videos and the possibility of adding new videos.

This research allows us to conclude that there is a trend toward creating mobile apps dedicated to the combat phase to inform about wildfires in real-time. About half of the analyzed apps focus on presenting information related to occurrences in a specific geographic area. Despite being beneficial for the general population from an informative point of view, this feature may not be essential for the communities

directly affected during the wildfires, as exemplified in the study carried out on the fires in Fort McMurray [4].

Apps targeting the combat phase are downloaded more often and contain more reviews in app stores. Its geographic scope and the interest of the general unaffected population may also contribute to that.

It was also identified a limited number of platforms exclusively to prevent forest fires. These mainly focus on disseminating good practices and behaviors or even forest management practices in text, video, and audio formats. The apps included in the typology of forest management do not have a connection to wildfires. They were only found in searches in app stores through the keyword 'Forest Management', which implies the disconnection between these two topics in digital platforms. Those included only in the forest management category have an international scope. Thus, sharing content between users is less efficient. On the other hand, apps with a regional context included in the information and prevention typologies present more detailed information about their area of reach. These can be more relevant to the target audience, somehow bringing people closer to local authorities.

Most of the analyzed applications focus on the combat phase with a national geographic scope in the Portuguese context. No application was found exclusively designed for community prevention or forest management assistance, which may demonstrate the little investment in this area. It should also be noted that there is no direct link between the planned and implemented prevention campaigns and any Portuguese mobile app, thus losing another media to inform and engage the population on wildfire prevention.

5 Conceptualization and Development of a Mobile App to Prevent Wildfires in the Portuguese Context

Based on the previous research, the definition of functional requirements that serve as a foundation and support for developing the prototype and its implementation are then carried out. The following sections describe the results obtained in each of the steps.

5.1 Functional Requirements

The definition of functional requirements is a fundamental step where all the possibilities of a system are described before implementation. It is essential to outline the system's features, some of its properties, and some of its restrictions. It is also necessary to define the usage flow and the data model that will be valuable in the implementation phase. After defining the functionalities and characteristics designed for the application, the prototype phase proceeds.

The first iteration of the functional requirements is based on the systematic review of the literature, the survey of mobile apps, and the study of Portuguese prevention campaigns. The results from the interviews and surveys collected by Liliana Gonçalves [6] on communication and digital needs in the context of rural fires are also considered to adapt the functional requirements to the needs of potential users. The priority was to define the target audience and understand their role in forest protection and fire prevention. Another important aspect was how all these different participants could communicate with each other and what they wanted to communicate. Creating a regional context makes it possible to delimit the areas of intervention, facilitating forest management, protection processes, and communication between the different actors.

Owners are responsible for managing their properties, including preventive measures and other maintenance actions. However, property abandonment and progressive depopulation of rural areas increase wildfire risk. Thus, service providers that facilitate the owners' management, performing the maintenance and prevention of the land more efficiently are also necessary. Inhabitants living in rural areas are also essential for active prevention and the primary beneficiaries of wildfire prevention. Finally, the authorities are also identified as territorial and rural fire management agents. The following table represents the identified profiles for the app and some of its possible prevention actions (Table 2).

Based on these data, the first functionalities were listed. To use the app and break the anonymity barrier, each user must start a profile registration. Considering the regionality context intended for the app, each user must define their region of interest in the registration phase. However, the app can also be launched by location. In the

Table 2 Users' profiles and their prevention actions

Landowners	Inhabitants	Services Providers	Authorities
– Private owners non-industrial – Private owners industrial	– Residents – Non-residents	– Forest associations – Forest sappers	– Municipalities – ANEPC (Civil protection) – Firefighters corporations – GNR (Police force)
Prevention measures			
– Management of fuel strips and protection of buildings on their land – Scheduling of burnings and burnings – Scheduling the use of machines – Surveillance – Post-fire vegetation control	– Surveillance – Safe agro-silvopastoral activities	– Surveillance – Awareness-raising actions – Identification of areas – Fuel reduction – Places of refuge identification – Certified areas management	– Surveillance – Creation of access roads – Elaboration and implementation of municipal forest defense plans against fires (PMDFCI)

registration phase, each user must choose their role for their region between the options Inhabitant, Owner, Service Provider, or Authority. The last two require a subsequent validation of the profile.

Two main actions were defined in the application to encourage community participation: Alerts and Public Actions. The execution process and the basic structure are similar for both functionalities: the user can see, through a map, alerts, or public actions created by other users or by himself, georeferenced to locate the place where these were created. Alerts can have different typologies corresponding to critical situations, such as poor fuel management or garbage accumulated in a specific area. When added, the alert is subject to validation by other users to reinforce the need to respond to it—the more checks by users, the merrier importance of the alert. The alert can also be certified by authorities responsible for changing the alert status.

Likewise, each user can create a public action georeferenced on the map or add their participation to one created previously. These arise from the need to create a platform for the local population to interact and be an active part in protecting their surrounding areas, protecting their properties, and buildings. They also have different typologies, such as clearing forests, plantations, or fuel management. In the public action add process, the user must define a date and the materials needed for the event.

Another feature resulting from interviews with citizens and institutions is a Forum that allows debate between different users. It comprises different subsections related to forest prevention and protection to funnel participation and minimize fraudulent and destabilizing interventions. Each section is also filtered by region to present posts related to the region of interest, improving the efficiency of the discussion and reducing the noise of posts or comments. Each user can add a new post associated with a topic or write comments on other posts.

This forum promotes communication within communities by giving potential participants a space to share their ideas or concerns. However, moderation is needed to maintain discussion quality and noise control in each subsection. This was a concern expressed by citizens and institutions during interviews. The forum section will integrate conduct rules to each subsection that all users must follow to address this question. It will have volunteer moderators, previously certified, who can range from members of the scientific community to community members actives in the prevention and forest protection.

The remaining features of the app consist of information areas with relevant data for populations, such as contacts of corporations or associations, spaces to disseminate good practices, risk behaviors, and services provided by associations inserted in the user's area of interest. Finally, each user can create and define areas of interest (surveillance) to receive notifications of alerts or public actions that intersect these spaces. The following table represents a general model of the application's features (Table 3).

Additionally, a section oriented toward the response to the combat phase was created. Here, the user can search for places of refuge near their location and mark these places as safe so that other users have this knowledge and can enjoy the space. The following table represents the roles of each type of user and their possible actions and characteristics (Table 4).

Table 3 Functional requirements defined for the app

Alerts	Public actions	Forum	Information
– With GPS location – Alert description – Different typologies – Alert status – Checks (users) – Certification (authorities) – Alert photos – Notifications	– With GPS location – Public action description – Different types – Date of the event – Necessary materials – Participants – Public action photos – Notifications	– Subsections – Posts and comments – Filtering by topics (help, information, research) and regions – Self-moderation	– Contacts – Good habits – Risk behavior – Service providers

Table 4 Profile types, possible actions, and content on the profile page

Landowners	Inhabitants	Services providers	Authorities
– Add alert – Add public action – Add posts	– Add alert – Add public action – Add posts	– List available services – Add alert – Add public action – Add posts	– Change alert status – Change public actions status – Create notifications – List contacts
Profile Page			
– Alert history – Public actions history – Areas of interest (surveillance) – Contacts	– Alert history – Public actions history – Areas of interest (surveillance) – Contacts	– Contacts – Services type list – Intervention area	– Contacts – Intervention area

5.2 Prototype

The prototype design was carried out using the InVision Studio platform and was designed to be demonstrated on a device with specific dimensions, namely the Samsung S8 smartphone.

This step aimed to compose a first version of the interface based on the previously defined functional requirements. Some key aspects were considered: the user profile, the type of use, and the application's environment. Graphically, the group of icons used should be easily perceptible and always supported by text. The color palette should also converge with the app's concept, using colors that resemble those of the forest and its natural environment. A different font group has also been defined for titles, subtitles, text buttons, and description texts. Screens were also created for each of the main features listed in the functional requirements step with interactions that allow the user to navigate through the different screens (see Fig. 4):

- home registration screen, with personal data and regions of interest or based on location;

- home page, with a menu with the different sections on the platform, information on alerts and public actions in the areas of interest to the user, and a navigation bar;
- user profile page, with information about their alerts, public actions, and areas of interest;
- screen for adding a new area of interest (central point and radius) to receive notifications of alerts and public actions in that area;
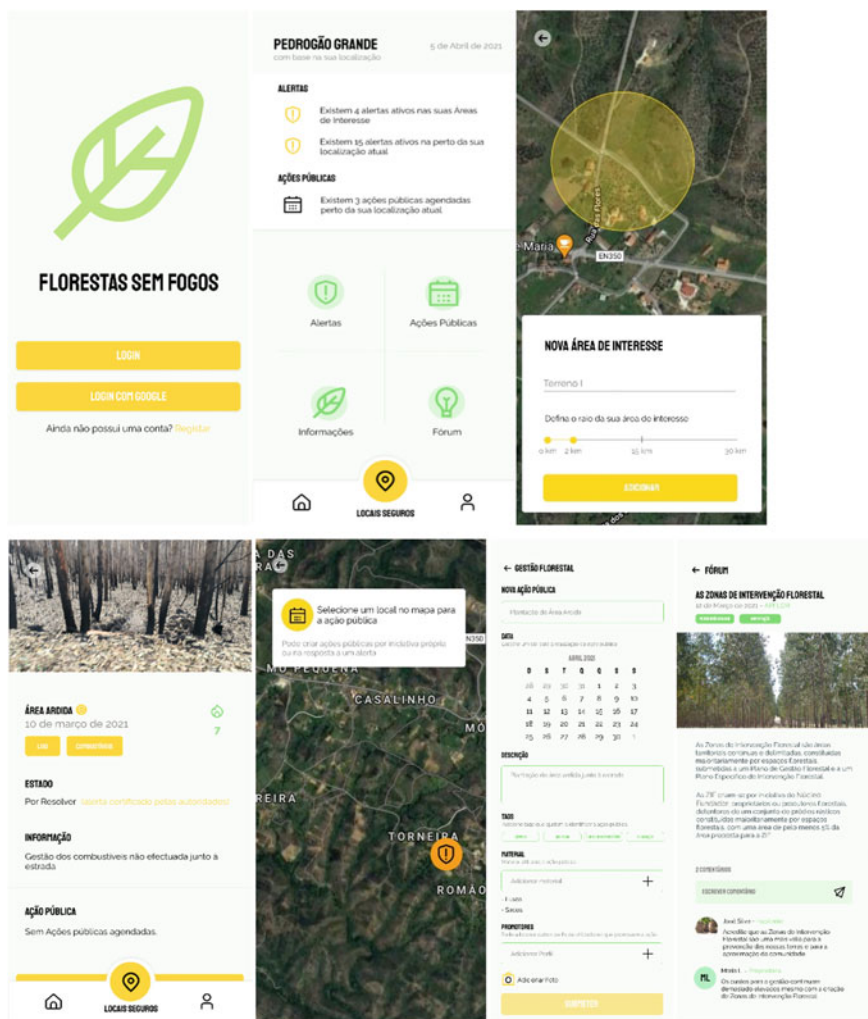
Fig. 4 Different screens of the app

- alerts screen, with information on typology, status, whether it has already been certified by the authorities, whether or not it has an associated public action, and an icon to check the alert;
- public actions screen, with information on existing actions in that area and the option to create a new one through a map with georeferencing and the possibility of adding images;
- forum screen, with a list of topics related to forestry prevention, protection, and well-being of the community, visualization of existing posts and comments filtered by region of interest, search filter by topic, and button to add a new post;
- information screen, with a carousel of topics and relevant content.

Usability Tests

The test consists of 6 tasks encompassing the main activities and application usage flows, with an estimated 10 to 15 min duration. Due to restrictions caused by the InVision Studio platform, which allows the creation of prototypes with screens of only one dimension, the tests were carried out in person using the Samsung S8 Smartphone. As a support tool, each participant was provided with a document that described the app concept, the participant profile, and the test tasks, with a space to assign a level of difficulty in the test execution and add pertinent observations. The research team had a similar document to record the behaviors and difficulties felt by the participant during the execution of the tasks.

Ten usability tests were carried out. Despite being a convenience sample, the profile of the participants was evenly distributed, corresponding to the audience defined for the mobile app. The participants' profiles vary between 25 and 63 years old, from students to civil servants and secondary and tertiary sector workers with different levels of qualification to owners and inhabitants of regions frequently affected by wildfires.

The test results showed some app usability aspects that needed reflection and some navigation problems demonstrated and exposed by participants. Some of the responses suggest adding a temporary "successfully added" feedback after creating an alert or public action. Another common suggestion is to give the possibility to see alerts or public actions in a list, thus providing more reading formats. One participant considered that the information at the top of the homepage regarding the user's region of interest and their current location should be buttons to access the respective sections and not just textual content. Finally, one participant suggested reflecting on the type of font chosen for the titles, mentioning that "they may not be easy to read".

Overall, the high-fidelity prototype received positive reviews from participants, who were pleased with the simplicity of the screens and ease of use. All these suggestions have been considered and applied in the app implementation phase described in the next section.

5.3 Implementation

The app implementation phase is still in progress. This section will describe what has been done until now and the future perspectives.

Based on the functional requirements and the designed high-fidelity prototype, services that best suit the app features and allow the easy integration of all the different system components were defined. After reading the documentation of different types of services available and considering the time constraints of the research, the decision was made to use Amazon Web Services (AWS) services that allow establishing a more robust connection and more accessible in temporal terms between the different systems components. Below is the list of services used and the system architecture:

- AWS Amplify (provides tools that streamline the development and implementation of the backend and frontend of a mobile application)
- DynamoDB (database)
- AWS AppSync (API)
- S3 (image storage)
- Cognito (user authentication) (Fig. 5).

In the figure, it is possible to observe the complete system architecture from the database (dynamo DB), its integration with the API (AWS AppSync), which communicates with mobile devices through the AWS Amplify service, which also adds the authentication service (Cognito) and the image storage service (S3). In the frontend component, the application is implemented using react-native, a javascript framework, allowing the development of the mobile application in Android and IOS environments and the integration with the remaining components of the system. However, the application is structured to work only on smartphones supported by the Android operating system in the current development phase.
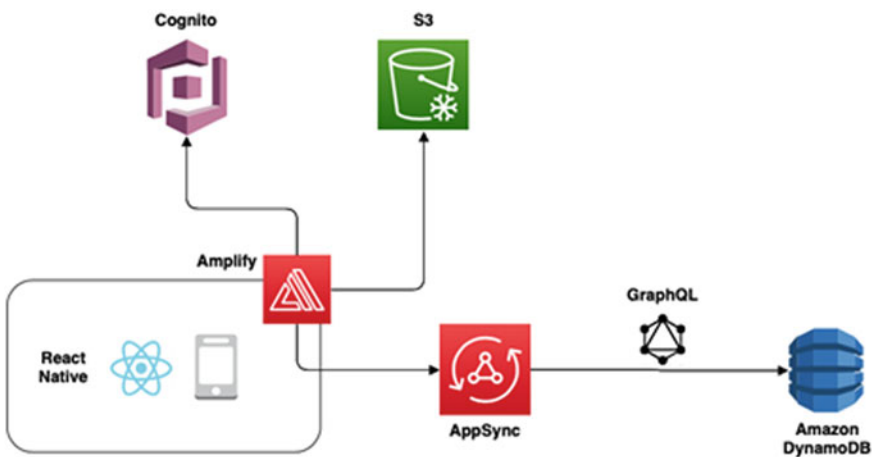
Fig. 5 App system architecture

The development of the system started with the installation of the Amplify CLI tool, which creates a backend structure for later integration with the mobile application. Then the project was initialized in react-native with a base structure of a mobile application. The next step consisted of integrating Amplify services into the mobile app structure. Thus, it became possible to integrate the remaining system components, such as the API, authentication, and image storage services.

For the database implementation, the data model and the necessary access points were generated by using Amplify CLI tool. Since this is automatic, it was only necessary to define the attributes of each database type and how they will connect between the different types.

The Cognito authentication service, which allows the management of users, user groups, and registration and login methods, was also integrated using the Amplify CLI tool through the 'amplify add auth' command in the terminal.

This integration process defined how users must acquire access to the application. It was then determined that the registration process would require a username, password, email, and mobile number for each potential user. Users will only need the email and password to log in to the app. Finally, the image storage service (S3), also added through the Amplify CLI tool, allows the creation of access points (URLs) for images used in alerts and public actions to be accessed whenever requesting them from the application.

Having configured all the services necessary for the system to function, the previously conceptualized functionalities started to be implemented. An implementation priority order was established to obtain a minimum functional product in the shortest possible time. Features like authentication, alerts, public actions, forum, and the profile page were prioritized. Below are some features already implemented in the mobile application (Fig. 6).

The user authentication process is currently carried out using the component provided by Amplify, which contains a pre-established workflow to log in or register. In the future, the goal is to customize the interfaces, as outlined in the prototype, and the process in the registration phase, giving the user the possibility to define their typology (Inhabitant, Landowner, Service Provider, Authority) and their region of interest. Those features have not yet been implemented.

The following figures show the app's initial menu, as the page that allows the user to navigate to all sections and the user profile page where their alerts, public actions, and surveillance areas can be seen. Currently, on the homepage, the user can navigate to the Forum section, Alert Maps, Public Actions, and the profile. The central button on the lower navigation bar and the upper section is not implemented on this page. It should contain immediate information about the alerts and public actions near the user's current location and region of interest. These two features will end the app implementation splash screen (Fig. 7).

The following figure represents the Alerts section, where it is possible to observe the georeferences already added to the map. Each marker on the map contains the associated alert details. These can be viewed by clicking on one of the available georeferences, and a pop-up will appear with the most relevant information. Here, the user can confirm the alert by clicking on the flame icon. The screen shows a
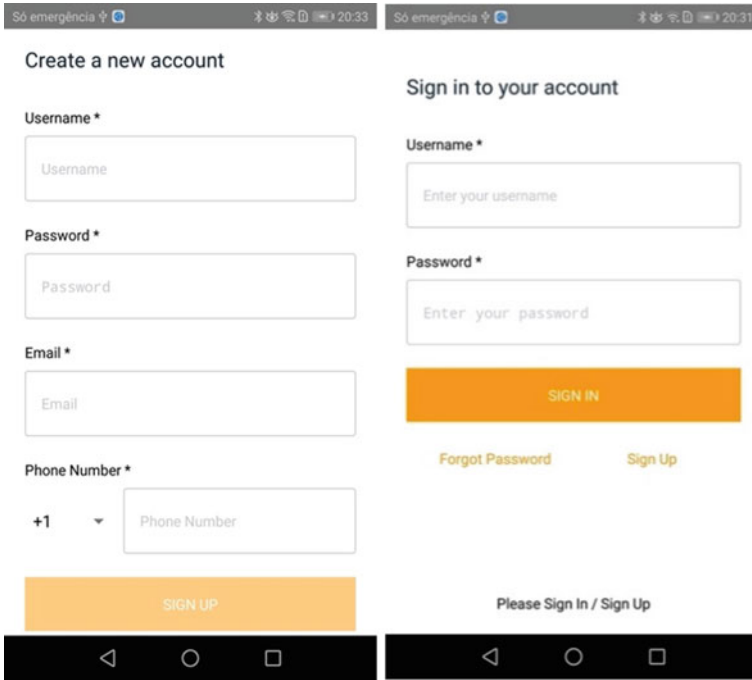
Fig. 6 Registration and login interfaces

new alert addition, which includes a georeference and its details, such as the title, a brief description, typology, and a possible photograph. To validate this form, the user must add at least the title and typology of the alert. After submitting the alert, it will appear in the initial map of the section.

For the Alerts section, the following goals depend on implementing the different user profile typologies, which will allow the alert status management, namely through a profile with the authority typology. Another aspect to consider is the implementation of displaying alerts in list format (Fig. 8).

The public actions section is identical to the one described for alerts. Here, the user also can check the public actions added to the map and their details through the pop-up that appears when clicking on one of the georeferences. As with the alerts, the pop-up contains a "see more" button that redirects users to a page with full details of the selected public action. There is also the functionality to add a new public action from the lower right button that, when submitted, will be added to the initial map of this section. The name of the public action, its typology, and a brief description must be added to it, a date must be defined, and a photograph can be added.

In this section, two steps will be added later: the validation process to add a public action and the possibility of adding necessary materials and confirmation of participation (Fig. 9).
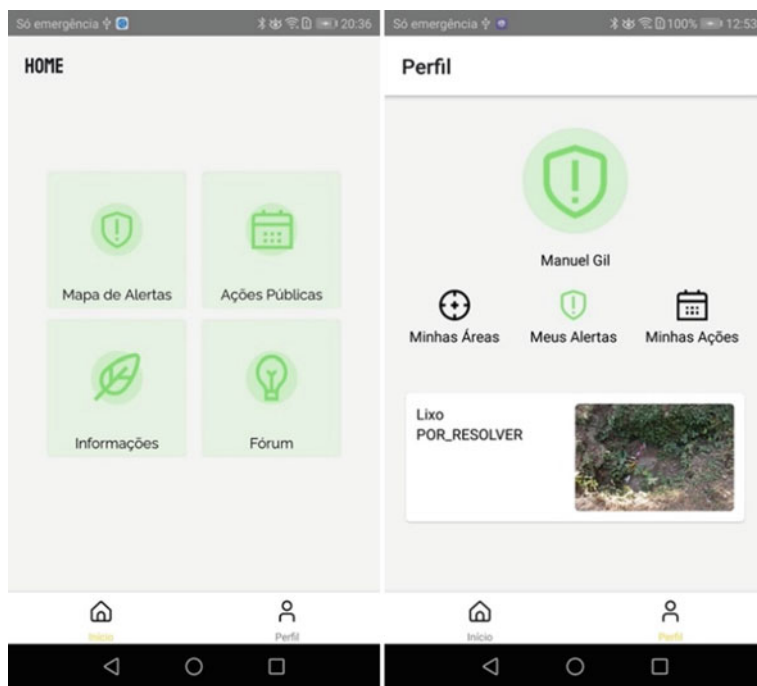
Fig. 7 Homepage and profile page
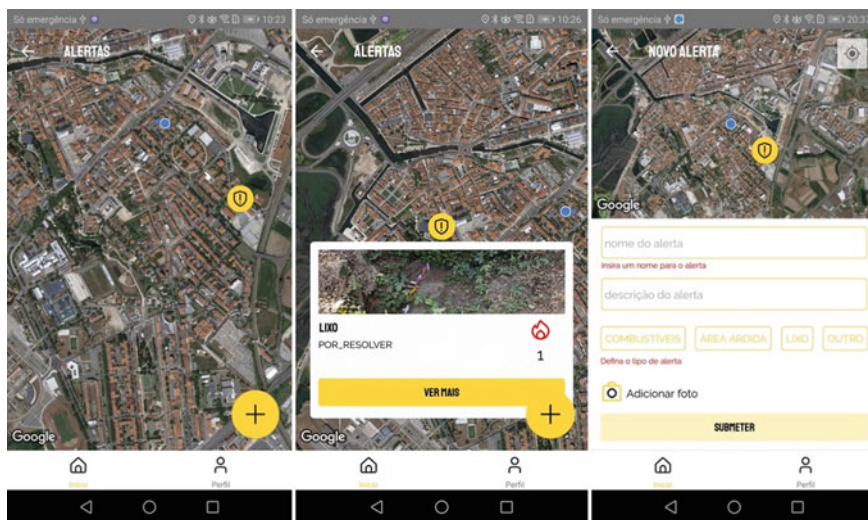
Fig. 8 Alert section
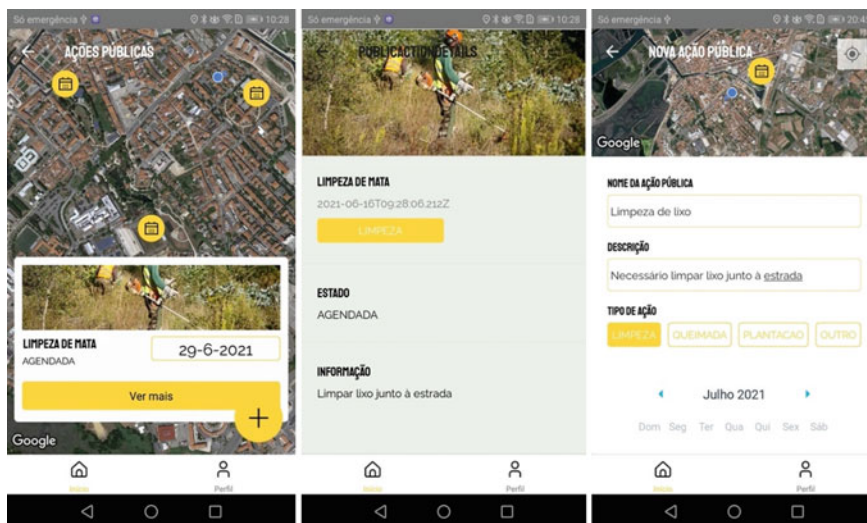
Fig. 9 Public actions section

The Forum section is represented in the following screens figures. It contains the initial section screen with the different categories displayed. The user can select the topic they want and be redirected to the list of publications referring to their chosen category. Each post contains the title, a quote from the text, the date it was submitted, and its author. As in the other app sections, the user can add a new post from the bottom right button. To add a new post, the user must add a title, a topic for later identification, and its textual content. Photos can also be added and displayed along with the text. It is possible to add comments to posts, which allow discussion and knowledge sharing between different users. This section's development goals are implementing topic and region of interest filtering functionality (Fig. 10).

6 Conclusions

Considering the current state of the art regarding digital platforms applied to wildfire prevention, this work, still in the implementation phase, contributed with practical results to the progress of research in this area. Regarding the current context of the Portuguese forest and the future levels of danger [12], there is an urgent need to adopt measures that reduce risk and keep the communities that inhabit the regions engaged with forest protection actions. Given this scenario, the opportunity arose to combine the two domains of this research: wildfire prevention and innovation in the development of mobile applications and, in this way, contribute to wildfire prevention through the use of digital services and devices.
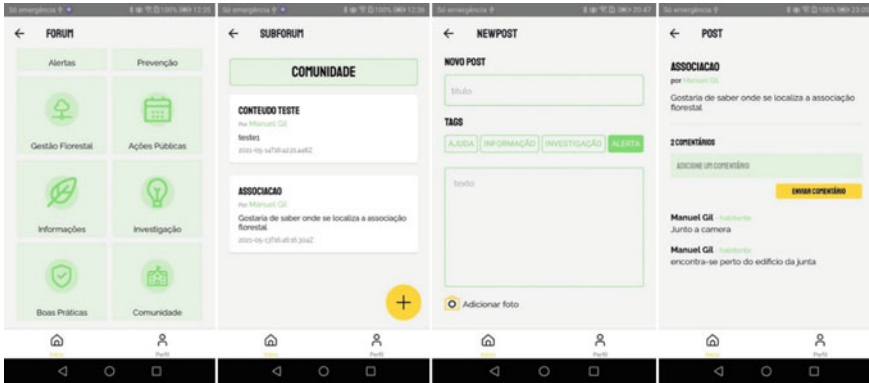
Fig. 10 Forum section

The theoretical framework allowed establishing a vast set of relevant data for the app conceptualization. The literature review identified the most advantageous systems for sharing information with an associated geographic context and its potential. The characterization of existing apps about wildfires enabled the systematization of the most used and most efficient functionalities. The study of the prevention campaigns carried out in Portugal provided a deeper understanding of the need to raise awareness and engagement among the populations in the digital scope. With this knowledge, functional requirements were defined to develop the mobile app. The app's potential users were identified and divided into different typologies. The general app features were designed, such as maps of alerts and public actions and the forum and information section.

The conceptualized mobile application provides communities with a platform to share information, discuss ideas, identify needs, increase the proximity between different actors, protect their forests in a regional context, and increase communication transparency between authorities and communities. On the other hand, the prototype developed, complemented with the usability tests for performance, allowed to put into practice most of the functional requirements previously idealized. In this way, it was possible to obtain a functional product that allows users to add content that they consider relevant, such as alerts, share ideas and knowledge, clarify doubts through the forum and create public actions to establish connections between community members.

Thus, the result of this research can be seen as a foundation for communicational proximity within communities living in forest areas—population, landowners, associations, and authorities. By using tools to monitor and protect their areas of interest and sharing information and knowledge with other stakeholders, communities can protect themselves and the forest from wildfires. Thus, using digital solutions such as the mobile app presented in this research can stretch the ties between actors, giving them a sense of belonging and a collective purpose to benefit the community and the territory itself. On the other hand, the knowledge collected, shared, and acquired

through the interaction with the app and users could increase the literacy about preventing wildfires, leading to the adoption of preventive measures and behaviors by all actors in each community.

In the future, the purpose is to continue the feature's implementation, increasing the robustness and security of the application and simultaneously sweetening the user experience, which is essential in this type of platform. Also, it will be crucial to plan the app implementation in Portuguese society through partnerships with local and national authorities, stakeholders, and awareness communicational campaigns.

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Design and Development of an Online Sales Platform for the Brand: Engenharia Do Brigadeiro

Viviana Maia , **Leonardo Pereira** , and **Daniel Brandão**

Abstract The research here presented consisted in the Design and development of an online store proposal for Engenharia do Brigadeiro (EB). This company only had a Facebook and Instagram page and, with the Covid-19 pandemic, it felt the need to reinforce its online presence, in order to reach more customers. Thus, we developed a Design prototype for the mentioned online store that should answer to both the company's needs and to its customer's needs. Methodology wise this research was divided into three stages: in the first stage we undergone a literature review about the currently undergoing consumers' buying habits migration into the digital context, and about User Experience Design. In the second stage we proceeded into understanding and modelling our user and its main needs and goals. And in a third stage, from all the data we collected from the previous research stages, we designed an online store prototype, which we further submitted to Usability tests. The conclusions drawn from these tests are presented at the end of this chapter.

Keywords E-commerce · User experience · Mobile website · Online shopping

1 Introduction

This research work focused on the development of a communication and online sales platform for a brand called "Engenharia do Brigadeiro" (EB), a small Portuguese company that sells made-to-order brigadeiros[1] online, through its Facebook page.

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[1] Brigadeiros are a traditional Brazilian dessert.

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Created in 2019, the company is in a growth phase, and in recent years it found that, due to not having any other online sales platform besides Facebook, it was at risk of losing customers. In addition, EB realized that many of its customers also wanted information about its products, such as how they were made, what allergens they might contain, whether they were suitable or not for celiac or vegan consumers, what the products' energy value was, among other product information.

Although EB only accepted orders through its Facebook page, it also had an Instagram page as these were the networks most used by its customers. However, the company felt that this kind of online presence was no longer enough to increase its sales and brand visibility. And so, with the development of an online store, they wanted to expand the way their customers could order and to increase their online presence. Therefore, the lack of a pro-active online sales and communication platform was a gap that EB needed to fill and which we proposed, with this research work, to try to eliminate. So, the challenge was to create a design prototype of an online store that would answer to these needs and motivations, both of EB and its customers, being this the main goal of this research work.

The conceived platform derives, therefore, from the combination of several sources of information and research, namely a survey about EB's own needs and requirements; the study and modeling of its most common user's characteristics (EB's customers) identifying, therefore, their main needs; and also a literature review about the migration of consumption habits from a physical context to the online context. This was done to fulfill the main goal of this research work, which was to make the process of buying products through the conceived and designed online platform easy to use, intuitive, pleasant and useful, for its future users.

2   Research and Project Goals

The current research work consisted in the study and development of a first prototype for an online communication and sales mobile platform for the company EB, with the goal of answering to the needs and motivations of both EB and its customers. More specifically, it was intended, through research in Design, to create a digital communication solution that, on the one hand, helped EB to increase its online presence and sales, and on the other hand, helped its customers to more easily and conveniently access information about its products and, ultimately, to purchase them. Therefore, by developing digital communication tools, the intention was to bring the EB brand closer to its current and potential new customers.

Knowing that the fulfilment of the goals identified above is a long process, this study focused on the conception, design and prototyping of the online platform in order to ensure, through the adoption of UI and UX Design strategies, and also through the implementation of Usability tests, an interface solution that is pleasant and easy to use for EB customers.

3 State of the Art

Since we set out to conceive and design a digital platform for food sales and ordering, it becomes imperative to understand what it currently means to buy something and how these transactions of goods and services operate today, particularly in the food business. In other words, what new behaviours are experienced by consumers (are they the same as in the past or not) and in what ways they operate. As will be described and analysed below, there are several factors that have driven this transition phase in which we find ourselves, from the typical purchase made in a physical store to the purchase made, also and in parallel, through digital platforms.

3.1 The Transition of Shopping Behaviours from the Physical Store to the Online and Mobile Context and the Factors Driving It

In recent times in Portugal, the ecosystem of transactions of goods and services, as in the rest of the world, is migrating to the digital environment, although not yet completely eliminating the purchase in physical stores behavior. As published by the Portuguese Trends Observatory in a survey developed by Grupo Ageas Portugal and Eurogroup Consulting Portugal [1, 2], although online commerce is growing, the majority of consumers say they still prefer to buy in-store [1, 2]. However, there are indicators that reveal a clear growth trend of shopping in the digital context. For example, in 2019, according to a study by DPDGroup, an average of 83,000 orders per day resulting from online purchases were delivered in Portugal, for a total of 20.7 million per year [3]. The same study also mentions that 35% of its respondents buy online regularly [3]. Already in 2019, according to the CTT e-Commerce Report 2020 study, 51% of Portuguese people with internet access had already made at least one order on the internet and it was estimated, at the time, that by the end of 2020 this number would reach around 56% [4].

On the other hand, the Covid-19 pandemic, also seems to have leveraged this growth in digital transactions. With the 2020 confinement and the consequent closure of physical stores in Portugal, buying online became the only way for some consumers to shop [1, 2]. In fact, 73% of e-shoppers claimed to have shopped online between 3 and 5 times a month [5]. And after a further confinement in early 2021, these circumstances only accentuated the growth trend of the e-shopping market, growth that, according to an ANACOM's[2] report about e-Commerce in Portugal in 2021, reached about 52%, 7 more points than in 2020 [6], figures and numbers which converge with the growth forecasts described in the CTT e-Commerce Report 2020 study.

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[2] ANACOM is Portugal's Communications national authority and regulator (anacom.pt).

Therefore, as can be easily seen by the data presented above, online shopping is already a very substantial slice of the overall shopping market in Portugal.

Another factor that is intertwined with this rapid growth of e-commerce in Portugal is the increase of digital apps' download. Data from the period after the confinement caused by the first wave of the pandemic, reveal that during this confinement the installation of Apps grew 70% compared to the same period of the previous year. And, regarding food consumption Apps (restaurants, Uber Eats, etc.) these grew 21% [7]. As in Portugal, the only forms of service available in restaurants were deliveries and Take Away services, this significant growth in the adoption of Apps for food consumption is understandable and expected. On the other hand, there was also a huge explosion of new online stores, restaurants started adopting the Take Away model, making deliveries and accepting orders through social networks [7]. These facts demonstrate how much the restaurant industry had to adjust to this new paradigm of electronic commercial transactions.

Regarding the use of mobile phones to purchase goods and services, there are also some indicators presented in market studies that show the growth of this purchasing behavior. For example, in the Portuguese context, from 2016 to 2018, the number of Portuguese who used their smartphone to make online purchases increased, according to the 2018 e-Shopper Barometer, by about 6 percentage points, reaching 54% in 2018 [8]. And in 2019, according to a study by DPDGroup, 72% of its respondents stated that they made their purchases through their smartphone and that this was the most used device when making transactions [3].

So, in conclusion, as can be seen from the data presented above and this new ecosystem of commercial transactions, it can be said that these new behaviours clearly support the relevance and need for companies or brands to have an online presence today and, in particular, an online presence adapted to the mobile platform, as it seems consumers are increasing their purchases through this medium. It is therefore necessary that they offer their customers and consumers digital tools that meet their new habits and modes of consumption. And EB is no exception in this regard.

4   Methodologies

Methodologically, this project was divided into three distinct stages, each with its own specific methodologies that are detailed below.

4.1   *First Research Stage*

In a first research stage, an extensive literature review was conducted on topics that were deemed relevant to this research such as the following:

1. The growing transition of consumer habits to digital and mobile platforms;
2. Interaction Design and User Experience Design (UX Design).

Regarding point 1 it was intended to understand how consumers buy and consume today. And, for that, it was necessary to analyze the growing use of mobile, and consequent download of applications, derived from everyday life and new consumer habits. Regarding point 2, it was intended to collect what other authors and researchers say about the Design of the interaction and User Experience, in order to, on the one hand, guide the design process of the EB online platform, and on the other hand, extract design requirements for this platform's design.

4.2 Second Research Stage

In a second research stage, a survey regarding the characteristics and needs of the user was carried out. It was intended, in a User-Centred Design approach, to mainly know and understand the characteristics and needs of the EB customers, in order to, from this knowledge, also extract Design requirements that would allow us to adapt the solution later designed to EB's target customers.

4.3 Third Research Stage

In a third and final research stage, from all the data collected in the previous ones, the design requirements of EB's mobile sales platform were determined. Next, we proceeded to the design and development of a non-functional and high fidelity prototype, using methodologies and concepts associated with UX Design (User Experience Design) and UI Design (User Interface Design). To this end, the following steps were performed: creation of the main persona; information architecture design through a sitemap; user flows; wireframes; interface design; and, finally, high-fidelity prototyping [9]. Finally, Usability tests were applied to the prototype with a sample of participants that were representative of the target audience, in order to understand if the solution and platform designed was easy to use or not, and if its interface had a good level of Usability. Each of these steps is briefly described below.

Primary Persona

Personas are, according to Cooper et al. [10], archetypes based on behavior patterns of real consumers that are discovered during the research stage (…). These abstractions, built on the common characteristics and needs of real consumer groups, are usually materialized as a fictional character representing potential users [10].

In the case of this project, only the Primary Persona was defined, which encapsulates the characteristics and needs of EB's eventual customers, as this is an academic project and of limited scope. This Persona was therefore defined on the basis of

an interview survey applied to the EB managers and on the basis of questionnaires applied directly to some of EB's customers, where data on age group, academic qualifications, technological and digital skills (use of computer equipment, use of social networks, installation of Apps on a smartphone, use of smartphone to make online purchases), geographical origin and needs felt by customers when making purchases with the current EB online presence were collected.

Sitemap—Information Architecture

Before moving on to the platform's UI Design it was necessary to define an information architecture. This refers to the structure and distribution of the content and functionalities offered by a digital product, describing how to navigate between the different pages and how they relate to each other. Therefore, it was also necessary, for the UI Design planning of this platform, to decide how to segment and organize the different contents and functionalities that would be displayed to the user, in order to understand how the user would interact with and navigate through it. So, a Sitemap (Fig. 1) was diagrammed in order to distribute and organize all the contents and functionalities resulting from the requirements determined for the design of the EB's platform.
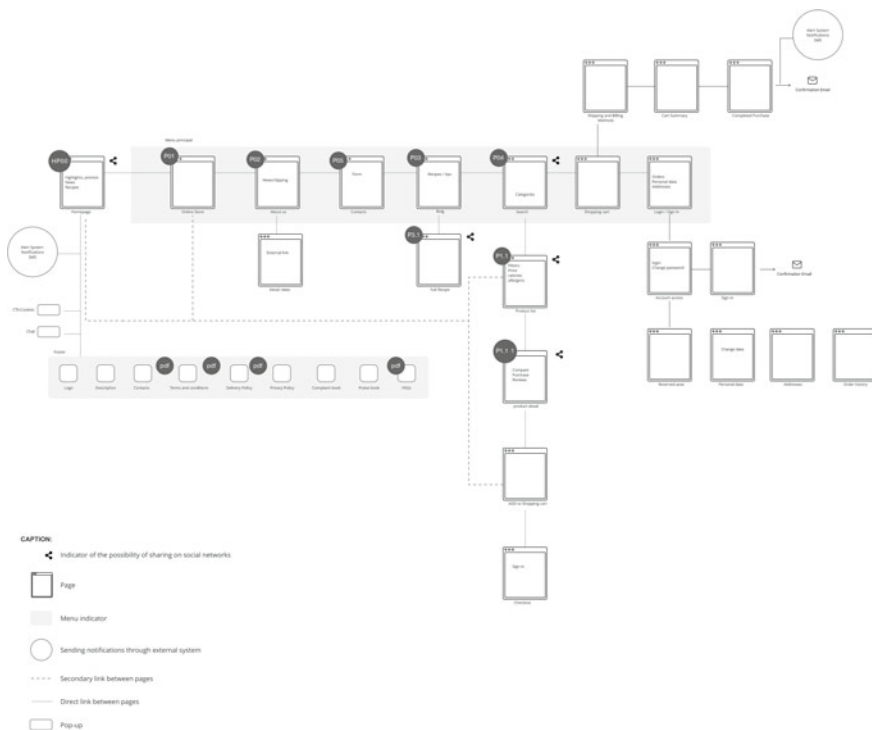
Fig. 1 Sitemap developed for EB's digital platform
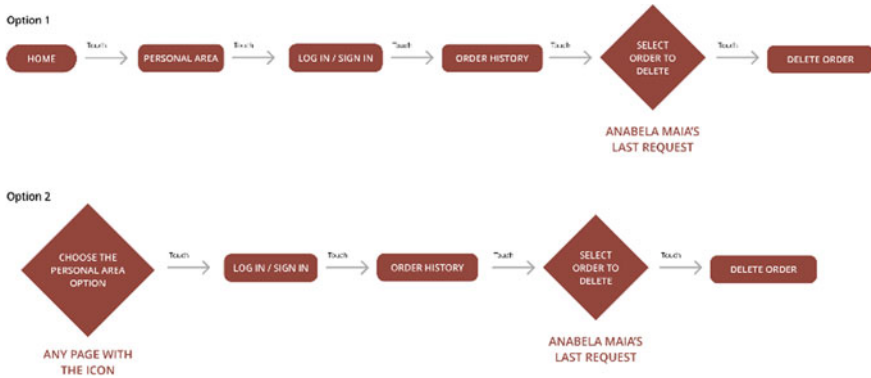
Fig. 2 Examples of User Flows designed for one of the platform's interaction tasks

User Flows

In the UI Design planning of this project User Flows were also created. User Flows are diagrams that represent, in a schematic way, all the steps and actions that a user has to sequentially perform (according to a specific order) in order to complete a given interaction task within a digital product. These help a Designer to define all the possible paths that an eventual user has in a digital product, to perform a given interaction task, in the fastest and most effective possible way. In the specific case of this project, 6 groups of User Flows were created (since some of these tasks had more than one possible execution path) that described the six interaction tasks that corresponded to the primary needs of a future user of the platform (Fig. 2). It should also be noted that the interaction tasks that were diagramed and planned with these User Flows were precisely the same ones that were then tested and assessed in the Usability tests that will be described later in this document.

Wireframes and Sketches

Next the wireframes of the platform's pages were drawn. Wireframes are the first sketches and visual composition studies of the graphical interface, using drawings with a low level of visual detail and usually without color. They are essentially used to help define the visual composition and relative positioning of all the visual and interactive elements that will be displayed on the different pages of a digital product's interface. In the specific case of this project, these were also used to quickly test several hypotheses of graphic composition and help define a visual and layout dressing for the platform's different pages (Fig. 3).

High-fidelity Design and Interface Prototyping

As far as the graphic Design's development was concerned, this was done in Adobe XD software and, later, a high-fidelity but non-functional prototype was assembled in the same digital tool (Fig. 4). The prototype can be viewed at the following link: https://tinyurl.com/mehzpy7k.

Fig. 3 Homepage's first sketch
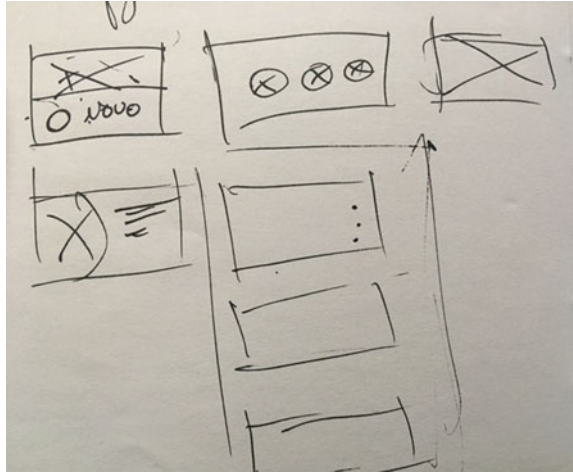
Fig. 4 Platform's prototype displayed in a IPhone X screen
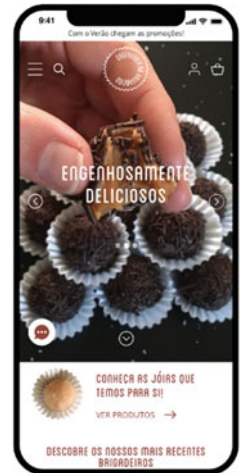
In terms of display resolution and format, the IPhone X screen resolution was used (375 × 812 pixels), since its format and size were similar to the device on which the Usability Tests of the prototype were later done, that is, an Asus Zenphone 5. As for the typography options, we chose to use two different fonts: Blanch Condensed and Open Sans. Blanch Condensed was used in the larger titles and in the product prices that are displayed on the platform's pages. The choice of this font derives from the fact that it is the main font used in some of EB's graphic communication materials, and especially in its logo. And as such, it is desirable to ensure graphic consistency among all the company's communication materials, which the use of this font also ensures.

With regard to Open Sans, we chose to use this font in the remaining text elements, since it is a Sans Serif font optimized for the web and for mobile interfaces. It therefore offers excellent readability on screen and at smaller sizes, which is mainly suitable for the smaller typographical elements of the interface such as smaller titles and paragraph text. On the other hand, it has a neutral and connotation-free appearance, which is desirable in order not to visually compete with the visual expressiveness of the primary font.

Regarding the adopted text sizes, size 16 points was used for paragraph text, size 8 points was used for less important text such as breadcrumbs, size 30 points was used for primary headings, and size 12 points was used for secondary headings.

Regarding the colors adopted for the platform's layout, in order to give it a cleaner and minimalist look, white was used as the page's background which was combined, to ensure graphic and brand consistency, the color previously adopted in the EB´s logo. That is, the hexadecimal color #9A3324, which corresponds to Pantone 484. For the text elements an 80% black was adopted in order to reduce the visual weight of these elements and make it more pleasant to read. In addition to these colors there are some shades of gray and red in the color scheme implemented, particularly in some of the pop-ups.

Iconography wise, icons that used common visual conventions were used, so that there would already be a familiarity with their meanings that would minimize possible problems of understanding and interpreting them.

5   Usability Testing

Once the prototype was finished, the last and third stage of this study was dedicated to the Usability assessment of the prototype and its interface with a sample of EB's target customers. With this assessment it was intended to test its ease of use so that, in the event that Usability problems or issues exist, they can be corrected and thus raise the degree of Usability of the interface to a level that provides the user with a pleasant, easy and comfortable experience of use and interaction.

5.1   Usability Assessment and Testing Sessions

A total of 5 Usability assessment sessions were conducted between August 21 and 26, 2021, with a sample of 8 participants. The sessions took place, in some cases, in the participants' home kitchen and, in other, cases in the researcher's kitchen, since this was the context in which the platform was expected to be mostly used.

Each participant was asked to perform 6 different interaction tasks with the prototype. These tasks corresponded to the primary needs of a future user of the platform. As far as equipment was concerned, the tests were performed on a smartphone

with the Android operating system, model Asus Zenphone 5, equipment where participants were provided with the platform's prototype.

Before the participants started any interaction task, the researcher who applied these tests explained to the participants how the tests would work. They were therefore informed of the following:

1. What the prototype platform consisted of and what it was for;
2. What the purpose of these tests was;
3. That given the non-functional nature of the prototype, the data filling fields would be filled in automatically with a mouse click;
4. That what was being assessed was the prototype, not the participant;
5. That while running the tests they would think aloud (Think Aloud Protocol);
6. A rough estimate of the duration of the assessment session.

After the completion of the tested interaction tasks, a satisfaction questionnaire was applied to each participant with questions such as the following:

1. Do you find it easy to get information in this online store proposal?
2. Did the online store proposal arouse your interest in the brand?
3. Do you consider that the interaction with the online store is simple and clear?
4. Do you consider the online store intuitive and accessible?
5. How do you characterize the website proposal? Not very interesting and not very useful? Interesting and useful? An interesting store that would be very useful to me?

5.2   Data Collection Instruments

In terms of data collection instruments the following were produced and applied:

1. A general script for the tests' conduction. This script included all the instructions and information to be given to each participant, as well as the order in which the tasks and actions would have to be performed throughout the tests by both the researcher and the participants. It also included an observations grid (for observations and task execution times registration). This ensured that the tests were always applied in the same way with all participants;
2. A satisfaction questionnaire. As it was also intended to measure the degree of overall satisfaction of the participants in using the prototype's interface and to verify whether the participants found the conceived Design proposal interesting and useful.

5.3   Recruited Participants Sample

For these Usability assessments a sample of the target customers of the EB brand was recruited. The sample was composed of 8 participants who, it should be noted, were

actual EB customers. Despite the small scale of the sample this does not invalidate the validity of the data collected since, according to Nielsen [11], testing with only 5 participants allows us to find almost as many Usability problems as if we tested with many more [11]. As for the sample's participants gender, 3 were male and 5 were female. Although the sample had male elements, we tried to make sure that most of them were female, since, according to EB, their clients are mostly female. In terms of age, the participants were between 18 and 60 years old. Regarding the digital skills of the sample most of the participants had enough digital skills to shop online and with a smartphone, as 5 declared they accessed the internet through their smartphone while 3 declared they did it through their PC. They are also all users of social networks. Regarding their vision capabilities, 5 of the participants stated that they already felt some difficulties and problems such as Myopia, Strabismus and Astigmatism, even using glasses. It should also be noted that one of the Participants had severe vision impairment and was included in the tests in order to understand if it would be possible for a user with special needs to use the online store, or not.

6 General Results and Discussion

6.1 First Major Conclusion

Regarding the results obtained, the first major conclusion drawn from the performed Usability assessments is that, at least in what concerns the interaction tasks tested with the designed prototype, they endow the interface with a quite reasonable degree of Usability, since the effectiveness levels are high and the global efficiency levels are medium. This belief of ours is based on the following data. Of the 6 tasks tested:

1. All were performed effectively. Only one task (namely, task $n^{er}1$) was not performed until the end by one of the participants (namely, participant n^{er} 5). All the remaining ones were able to execute both that and the other tasks successfully;
2. Only in tasks 1, 4 and 5 there were some problems of efficiency in their execution. In the remaining tasks there were neither critical errors (errors that prevented the progression of the task execution from a particular step forward) nor non-critical errors (errors from which participants would recover). However, in those in which some errors were observed, with the exception of task 1, the quantity and type of errors observed was not enough to state that they were of completely inefficient execution, since, when participants made errors, they were always non-critical errors.

On the other hand, the results of the Satisfaction survey seem to reinforce and converge with our conviction that the designed interface enjoys a quite reasonable degree of Usability, since:

1. All participants mentioned that they had no major difficulties in performing the tasks tested;

2. With the exception of participant n^{er} 5, whose vision difficulties did not allow him to read some font sizes, namely 12 pt and 8 pt, or to interpret the icons on the prototype, all considered it easy to obtain information on the developed prototype;
3. Most participants found the online store prototype simple and accessible, with the exception of 2 participants whose visual limitations did not allow them to understand the prototype in its entirety. These participants stated that they could not see some icons of the interface correctly, namely participants n^{er} 5 and n^{er} 7;
4. The participants considered the online store prototype accessible and of clear interaction. With the exception of 2 participants whose visual limitations did not allow them to understand the prototype, namely participants n^{er} 5 and ner 7;
5. In general, participants rated the developed prototype as "Interesting and Useful" and as "An online store that would be very useful to me";
6. The participants considered that the prototype is functional and corresponds to their needs.

6.2 Second Major Conclusion

The second major conclusion to be drawn from the results of these tests is that, despite the fact that the interface of the prototype already enjoys a very reasonable degree of Usability, the errors made and the participants' suggestions, show that there is still some room for improvement. Therefore, in a future design iteration, the following adjustments or reformulations should be implemented:

1. It should be possible to enter the purchase process through the product comparison feature page (add button for this purpose);
2. It should only be presented one date suggestion for the order's pick-up.

6.3 Third Major Conclusion

While testing, we found that the interface of the prototype may offer some challenges and difficulties to some of EB's older customers. This conclusion stems from the fact that 2 of our participants suffer from some major vision problems (namely participant n^{er} 5–53 years old) and are not familiar with visual conventions typically used in the digital world (namely participant n^{er} 7–60 years old), such as specific icons widely used in the digital world. These participants, given their characteristics (age, visual difficulties, low digital literacy), were confronted with some difficulties in the Usability Tests carried out, which tell us that the Design of our interface should suffer some changes in order to accommodate their limitations since the EB's target customers also include people in older age groups. Thus, in a future iteration of our prototype design the following adjustments should be accommodated:

1. Increase the font size (ideally at least 16 points), or at least provide some sort of functionality that allows the user to increase the font size if they need to;
2. Review the design of some icons, such as the trash can, which was not recognized as such by one of the participants;
3. Design larger icons and add to them a written label with their name/meaning, in order to make their interpretation more effective;
4. Use higher typography weights than Regular;
5. And include the possibility for the user to use the platform with a black background or make use of a contrast adjustment feature.

Finally, given the results presented and discussed above, it can be said that these were quite positive, given that the participants successfully performed most of the interaction tasks requested, and it was shown that the methodological strategies and research path adopted, focused on a User-Centred Design approach, produced the desired results.

7 Final Conclusions

This research project presents as final output a proposal for the design of an online mobile sales platform for the company EB, with the goal of helping this company to expand its sales and to provide its customers with a more convenient, fast and efficient way, both to find information about its products and to actually buy them.

Through a methodological approach in which: (a) the current ecosystem of behaviours and online consumption habits was studied and analysed; (b) in a User-Centred Design approach, the needs, characteristics and difficulties of EB's customers in their relationship with the brand and its products were studied, as well as the needs of EB itself; (c) design processes inherent to the practice of UI and UX design were applied; a proposal for the interface design of an online sales platform was conceived, designed, prototyped and tested in terms of its Usability. The goal was to ensure the design of a platform and its respective interface that is easy to use by its eventual users and that they consider useful in meeting their expectations and needs.

During the development of the project, to the better understanding of who is the typical customer and user of the platform, it was essential both the contributions with data about their customers by the EB managers, as well as the data that was collected in questionnaire surveys directly applied to a sample of customers. These contributions made it possible to map both the characteristics of users and to identify their needs and, thus, to conceive and design the platform with all the necessary data, content and operational functionalities according to the aforementioned mapping and user modelling.

With regard to the results obtained with the Usability tests, these indicate that the research methodologies used helped to create a prototype with a user experience that, although still needs some revisions and improvements to its design, was globally

pleasant and reasonable in terms of the degree of Usability experienced by users. Only in one of the 6 tasks tested and only one of the 8 participants of the sample (the other 7 successfully completed the task) did not complete the execution of that task, which demonstrates the high rate of effectiveness of user interaction with the interface. In terms of task execution efficiency, some interaction errors were observed in 3 of the 6 tested tasks. However, with the exception of one of the three where errors were observed, the quantity and type of errors observed was not enough to state that they were of completely inefficient execution, since, when participants made errors, they were able to recover from them (non-critical errors) by themselves and carry out the task until the end. Therefore, these errors demonstrate that the interface of the so far developed prototype, despite already presenting a reasonable degree of usability, should still be subject to another Design iteration to try to minimize the observed errors.

Given these results, it is believed that, after a new Design iteration to eliminate the interaction errors observed with the prototype interface, the future implementation of the studied, designed, prototyped and tested Design proposal can successfully meet the needs of both EB and its customers. It may, on the one hand, increase the sales of EB products, thus bringing the brand closer to its customers. And it can, on the other hand, make it easier for customers to access information and purchase products, processes that with this digital tool will be accessible from the palm of their hands. Which of course is more comfortable and convenient, since it doesn't force them to physically go to the store.

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Protecting Users' Information and Dignity Through Privacy-Enhancing Design

Davide M. Parrilli and **Rodrigo Hernández-Ramírez**

Abstract The research presented in this paper discusses the risks that users of messaging services may face due to other user's misuse of the formers' personal information. While existing literature about privacy often focuses on the misbehavior of "Big-Tech" and governments, careless users can be as (or even more) dangerous to privacy as these institutions. Through a couple of examples where personal information is compromised in user-to-user conversations on two major messaging services (i.e., WhatsApp and Telegram) this paper analyses the phenomenon and how each platform's design matches against it. The research here presented shows that both services have in place features that allow users to protect themselves from other users' carelessness. However, it also shows there are existing loopholes that prevent a satisfactory level of protection and, through an exercise based on speculative design, suggests an alternative scenario were users have total control of their information as well as capacity to protect it against careless and malicious use from other users.

Keywords Interactions · Privacy · Service design · Speculative design

1 Introduction

Design is fundamentally a humanistic activity as it involves humans making things for humans. From a broad ontological standpoint, humans are "composed" of physical particles such as atoms and their components whose complex interactions allow us to process nutrients, experience the world, and think. Depending on ones' beliefs it may be argued that humans are also made of intangible, "spiritual" components. Recently, some philosophers have argued that human ontology can also be understood from a third dimension: as information. Oversimplifying, the idea is that every

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person is constituted by their physical embodiment, their psychological states, and their *information* [1]. Hence it follows that threatening somebody's informational privacy—i.e., misusing their personal data, such as name, contact information, and images—is tantamount to threatening their identity.

Just like body and "soul" may be inextricably connected, information cannot be understood in isolation from the bodily and cognitive dimensions of a person. When someone receives a punch, they experience not only physical but likely emotional distress as well. Likewise, pronounced cognitive stress may have bodily manifestations (e.g., physical pain or discomfort of all sorts). Forms of violence that initially involve personal information such as "revenge porn"—that is, the unauthorized publication of intimate images of ex-partners, which is overwhelmingly carried out by men as retaliation—can have severe psychological consequences for the victim.

Much has been said about the dangers of misuse of personal information by governments and corporations. In the last decade, the expression "surveillance capitalism" [2, 3]—a business model based on the massive accumulation and trading of people's personal data, with potentially severe political, economic, and ethical consequences—became widely used. Arguably, surveillance capitalism is a specific aspect of the broader "surveillance society" [4], already characterized by Michel Foucault in 1975 as a (physical and virtual) Panopticon [5] (Fig. 1).

According to the proponents of surveillance capitalism, governments and corporations can predict and ultimately control our choices and behaviors by collecting and processing our everyday information. The paradigmatic example is the Facebook-Cambridge Analytica Data Scandal, in which the social platform allegedly influenced the results of elections by (mis)using data and manipulating people through the information they consumed [6]. However, except for despotic governments, it is not likely

Fig. 1 The Panopticon, originally described by Jeremy Bentham in 1791, was conceived to allow a prison guard to constantly monitor all inmates from a central tower without being seen. *Source* https://www.nytimes.com/2013/07/21/books/review/the-panopticon-by-jenni-fagan.html
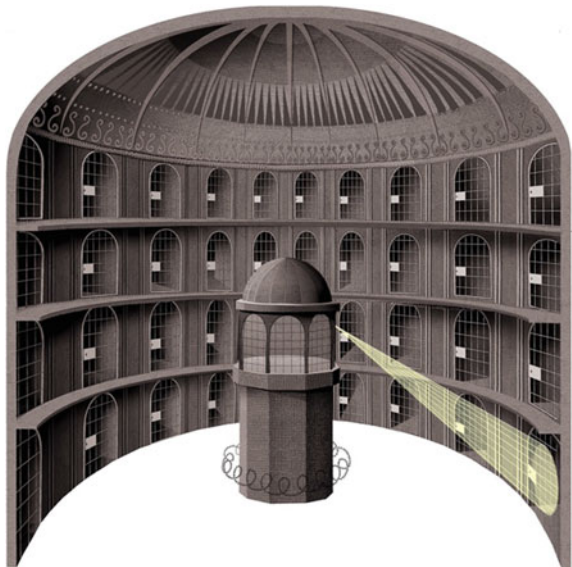
that companies *intentionally* mishandle personal information to cause distress to the people using their services. Data leaks that expose people's personal information, causing them various types of harm, happen too often. But logically, and legally, actively disseminating personal data to cause a damage is different from recklessly leaking personal information. Appropriate and strong security policies and IT solutions tend to prevent data leaks but are ineffective against voluntary disclosures of personal data.

This paper shows how design can contribute to prevent mishandling of personal information by other users, typically the recipients of the sensitive data. Interpersonal relationships cannot be regulated by policies, and IT solutions may also have a limited impact. For example, private images may be safely exchanged over a system that uses end-to-end encryption, nevertheless the data may still be mishandled by the legitimate recipient without the sender's knowledge and consent. In this example, elementary civility could prevent the recipient from sharing the images received without the sender's authorization. However, ethics cannot be preventively imposed: authorities can punish wrongdoers for unethical behavior (*ex post* enforcement, to punish the offender after committing an infraction) but cannot force people to act ethically[1] (*ex ante* enforcement, to prevent the potential offender from committing the offence).

Design should also be understood as a way of building ethical interactions between users. This paper analyses how design can ensure that interactions *with* and *for* privacy effectively take place. This article builds on our previous research about design ethics and privacy: design should not only be concerned about privacy but should be a tool for privacy. Design for privacy, based on universally acceptable ethical principles, empowers users and citizens by respecting their information and informational privacy and is conceived to be a conceptual tool to implement privacy in a designerly way [7].

1.1 Methodology

In this paper we present a case study of design for privacy. Specifically, we assess how two popular messaging services, WhatsApp and Telegram, mitigate the risks related to the misuse of personal data in peer-to-peer communications.

Having approximately two billion users worldwide, WhatsApp is arguably the most popular messaging service in the world.[2] WhatsApp is part of the Meta group,

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[1] Ethically/unethically or legally/illegally. For the sake of simplicity and clarity we assume that legality and ethics tend to correspond—often, what is unethical is also illegal, such as in the case of defamation as result of the publication of private pictures or videos. However, an unethical behavior may be legally irrelevant, e.g., when somebody shares to third parties a friend's trivial information, despite her request to keep it secret—or ethics and legality may collide. In this paper we focus on ethics from the perspective of the sender of the information, irrespective of the legal qualification and consequences.

[2] Source: https://www.statista.com/statistics/258749/most-popular-global-mobile-messenger-apps/ (last accessed: 25 January 2022).

along with other social media platforms such as Facebook, Facebook Messenger, and Instagram. According to recent data (October 2021), Facebook Messenger is the second most used messaging service, followed by two Chinese services (Weixin/WeChat and QQ), and Telegram comes in the fifth position.[3]

We decided to compare the privacy features offered by WhatsApp with those of Telegram for various reasons. Firstly, because Telegram is not owned by Meta. Secondly, because to use Facebook Messenger, users need an active Facebook account—our research focuses on messaging services that only require a smartphone or computer and a registered phone number to operate.[4] Finally, for cultural reasons: WeChat and QQ are extremely popular in China, but less so in Western countries, where the authors of this contribution live and work. Moreover, privacy is understood differently in China than it is in Europe [4, 8–10], therefore, uncritically using a Western conceptualization of privacy to evaluate services designed for and within a different cultural context would lead to biased conclusions.

Telegram, a service launched in 2013 by the Russian brothers Nikolai and Pavel Durov, is interesting for our research also due to the controversies associated with it. The service has been accused of being the tool of choice for terrorists, far-right extremists, copyright infringers, and other criminals, including child molesters. Recently (January 2022) a member of the Brazilian High Electoral Court suggested that Telegram ought to be banned in the country due to its alleged role in spreading fake news during the 2022 Presidential elections.[5] In the last years, Telegram has been censored or blocked by authorities in countries such as Iran and Russia [11].

Section 2 presents an introduction to the relationship between design, interactions, and privacy through the lens of service design and UX design. We point up a gap in the existing literature and research concerning the interactions between users of a digital service. We claim that service providers have an ethical duty to offer services that minimize potential abuses against data privacy by end-users. In Sect. 3 we present an overview of the features that WhatsApp and Telegram offer to protect the privacy and confidentiality of senders' information. We assess how the two services tackle problems concerning data privacy from a design perspective to guarantee safe interactions between users. Finally, Sect. 4 offers some concluding remarks and an introduction to the development of our research.

2   Designing Interactions for and with Privacy

Nowadays, most people are constantly connected with others. While a person may be physically alone, they are connected to other humans thanks to the digital device(s)

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[3] Source: see footnote 2.

[4] The research has been conducted by the authors in January 2022 on the apps installed on their phones (iPhone using the operating system iOS v.15.2.1).

[5] Source: https://extra.globo.com/noticias/brasil/tse-estuda-banir-telegram-do-brasil-para-com bater-fake-news-nas-eleicoes-25360713.html (last accessed: 25 January 2022).

they carry. As explained by Floridi, we live in an *onlife*; a circumstance where offline and online experiences are blended [12]. For example, one may be sitting alone in one's house drinking tea (offline) and chatting with a friend from the other side of the world through a messaging service (online).

Onlife interactions usually take place between: (1) a user and a given service provider—e.g., a typical banking app allows a client to interact with the institution and little more; (2) mainly or exclusively between end-users, as in the case of messaging services, where interactions with the service provider are extremely rare; (3) between two or more users and between users and the service provider—e.g., hosts and guests interact with each other through the Airbnb platform. Service providers and users are asymmetrically related: users create the interactions, but service providers, through their design choices, shape the ways in which interactions happen. Designers define the conditions for possible interactions offered by a service: what could happen during these interactions and how the system behaves towards users [13]. However, service providers do not have absolute control over the interactions *between* users. Customers of a dating app could use it not to flirt, but to share information about their academic research, although the app was originally designed to share other types of information. The interactions that take place are always shaped by the users themselves. Hence, one may argue that contemporary interaction design no longer designs things, but shapes conditions for something to happen [14]. This is not to say that designed function is eschewed. The *raison d'être* of a chair is to allow someone to sit; that of a phone is to enable two-way communication; and that of a car to allow people to go from one place to another. The key aspect of twenty-first century design is that, being increasingly digitally driven, it has to account for interactions and, in the case of communication products, for interactions between users (Figs. 2 and 3).

Since the 1990s academic design literature has been concerned with the qualification of the relation between services and interactions. Elena Pacenti, in her pioneering 1998 PhD work, defined service design as the design of arenas where interactions between services and users happen [15]. This view is a consequence of the interactive nature of services, where design methods and skills are applied to enhance the user experience, according to a Human-Centered design paradigm [14]. Cooperation between service designers and UX designers is thus required to create the

Fig. 2 The PS2 stereo turntable, designed in 1963 by Dieter Rams for Braun, allows users to listen to records, but not to interact with other users, unless they are in the same room. *Source* https://www.moma.org/collection/works/1164

Fig. 3 Music streaming
services like Spotify allow
users to listen to their
favorite music and to share it
with other people. *Photo
credit*: the authors
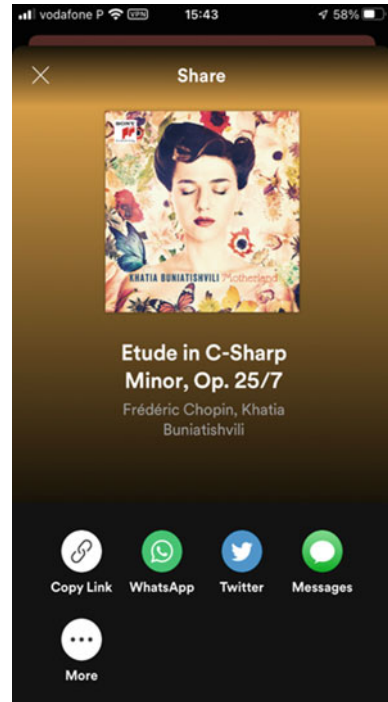
conditions for appropriate interactions. Consequently, while service designers are typically called upon to model the service, UX designers are tasked with making the conditions that allow the interaction between clients and service satisfactory— e.g., through an interface that considers the actual needs of the user. In practice, the distinction between the two is often murky and, for the matter we are discussing, unnecessary. Our analysis concerns the quality of the interactions, rather than the job descriptions of designers.

2.1 Interactions and Privacy

Interactions between users are key for platforms such as Facebook, Twitter, and for every messaging service. The service provider mediates the relations between end-users. Platforms nurture interactions between consumers in several business domains, ranging from real estate and tourism (e.g., Airbnb) to fashion (e.g., Vinted). The service provider takes care of issues such as payments and assistance to both the seller and buyer, without actively interfering in their interactions.

The role of the service provider is now more silent than it was in the 1990s when Pacenti published her findings. From the perspective of privacy, platforms collect data about users surreptitiously, without informing clients. Tracking technologies

allow service providers to gather clients' personal information. Third party cookies, web beacons, pixel tracking technologies permit to surveil and accumulate personal data without the users' awareness and consent.

The privacy-related problems emerging from the relation between service providers and users has received considerable attention in the legal and social science literature, but less so in design theory. This paper builds on our previous research to understand how service providers should protect users' data through design [7, 16, 17]. However, we understand that focusing exclusively on the relation between service and consumers is not sufficiently accurate and comprehensive. Recent views tend to see users as victims of Big Tech corporations that rely on user surveillance as their business model [3, 6]. Reality, however, is more complex and thus the assessment should be more nuanced. We contend that one should not overestimate the power of large technology corporations such as Apple, Google, Facebook, and Microsoft [18, 19]. IT companies may be very good at marketing technologies that promise an endless world of possibilities, however, the actual features are often lacking.

The tech landscape is dictated by the technological and design advancements of the companies populating it, but also by external policy and financial aspects. For instance, we wonder whether Google and Facebook dominate the online advertisement market because their solutions are the best from a technological standpoint, or rather because the regulatory framework—including data protection legislation—allowed them to crush the competitors [20]. Excessive red-tapism, which poses heavy regulations on small and medium size enterprises, combined with a lack of efforts to limit market concentrations through aggressive acquisitions and takeovers of competitors by the wealthiest companies [18], hinder innovation [21]. When applied to privacy protection, oligopolies are particularly pernicious. The few big corporations controlling users' data tend to increase their control and surveillance, while reducing the quality of their services and the level of the privacy offered [22]. However, this does not mean that technology as such is bad for privacy: a proper design of technologies can enhance and preserve privacy [1].

Furthermore, users tend not only to accept, but also indirectly promote surveillance by service providers and other users. Voluntary surveillance [23] is part of our onlife: are end-users obliged to share all their daily experiences and thoughts on social networks? From their perspective, platforms stimulate consumers to share content with other users, ranging from the birth of a child to what they are having for dinner, but do not have the power to force them to do so. Service providers, with the help of media and entertainment companies, actively promote the idea that people need to be engaged in social media and share as many details as possible about their everyday lives to be successful and enjoy a full life. However, assuming that people do not have the autonomy to think and act differently is a reductionist position. The pleasure and well-being that social media users obtain from these services should not be underestimated when trying to understand their behavior [24, 25].

Designing services that make interactions possible is necessarily an ethical activity [13]: the designed interactions[6] should respect and potentially enhance users' privacy and protect them from misuses both by the service provider itself and from other users. Designing services for interactions with privacy in mind is a matter of creating safe digital products: it represents the logical expansion of the principles defended over the last decades by designers such as Victor Papanek and Dieter Rams. In the 1970s, Papanek invited designers to decide whether their products would contribute to social good or not—having himself a clear preference for the former, he thus challenged designers to be conscious of their social and moral responsibilities [26]. The 6th principle of Good Design proposed by Dieter Rams in 1976 says that design must be honest: that a product should not be presented as better than it really is [27]. Honesty—and usefulness, according to the 2nd principle—should help prevent design from harming users. It is curious that Rams did not explicitly consider in any of his principles that design should not harm users, most likely because this is such an obvious idea. However, modern design offers plenty of examples of products that are addictive, or designed to benefit companies, venture capitalists, and shareholders but not users [26, 28].

We claim that it is the duty and responsibility of ethical design to create solutions that allow fair, healthy, and privacy-oriented interactions between users. Communication platforms have policies that govern users' behavior and that prohibit discriminatory and offensive content, or infringement of third parties' rights. However, these policies tend to be enforced *ex post*, i.e., once the offending text or material has been published. Furthermore, those rules apply de facto only within platforms where content is publicly available or is accessible by more than one user (e.g., Facebook and Twitter). Consequently, those protection mechanisms are usually ineffective in user-to-user or user-to-group messaging services. An example will clarify this point. Let us suppose the authors of this paper were to create a denigratory deepfake video of a colleague and post it on Facebook and Twitter, other users could notify the service provider, which in turn would delete the message and penalize us.[7] Alternatively, we could share the deepfake video through a messaging service with all our contacts but not with the victim. In this case, every recipient could also share the message with their own contacts; no policy could prevent such cascade effect from happening.

The solution to these complex situations requires a technological approach too—we envision a future where everybody would be able to delete and limit the sharing of videos and images, even outside their sphere of control using, for example, Artificial Intelligence (AI).

Our research is concerned with the current stage of development regarding personal control of private information. In the next section we will present a case study where we compare the features related to privacy protection of two popular

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[6] We use the expression 'designed interactions' for the sake of simplicity and clarity. We commented in Sect. 2 that interactions cannot be designed, but that designers can only create the conditions for interactions to happen and flourish.

[7] However, we should note that the enforcing effect of the policy is limited—we could share the video on several Facebook groups, to minimize the risk to have it erased by the platform.

messaging services, WhatsApp and Telegram. We will assess what users can do to prevent and limit abuses regarding private information included in texts, video, and audio files shared with other users.

3 Preventing Abuse Through Personal Information Mishandling on WhatsApp and Telegram

In this section we explore how, in terms of their design, WhatsApp and Telegram protect users' privacy and information confidentiality. The methodology we adopted is field research using both apps and exploring their features. For this reason, we did not consider their privacy policies, nor how the companies collect and process users' personal data. Privacy in the context of this paper is not understood in legal terms. Our concern is to understand how these services protect the personal information of their users against potential misuses by other users. The processing of personal data by private individuals for personal reasons is not legally relevant, e.g., for the European General Data Protection Regulation (GDPR) and the California Consumer Privacy Act (CCPA). However, mishandling of someone else's personal information by a private person could be legally relevant and may lead to criminal prosecution and civil compensation for the victim.

Potentially sensitive information does not necessarily have to be stolen or extorted to be publicized, in fact, it is mainly disclosed voluntarily by people to other people or to a restricted group of individuals. Various authors assume that privacy protection applies only to personal information that is unknown or unknowable [1]. However, we argue that this approach is insufficient: if we consider that personal data are part of one's identity, it deserves protection irrespective of the secret or public status of such information. The opposite approach would transform privacy into a powerful tool of oppression and discrimination—it is easy to imagine the consequences if personal data about somebody's sexual or political orientation could only be protected, provided that and until it is secret.

Usually, people willingly share personal data with one or more recipients that they trust. Trust is strictly related to privacy [29], and violations against the latter often involve infringements against the former. Messaging services effectively function as closed networks of trusted relations [30] and are widely regarded as trustworthy tools for intimate communication [31]—trust works in a twofold way: towards other users, and towards the services that enable communication.

The following examples may help to clarify our assumption and show the importance of trust when disclosing personal information:

1. A temporary worker is part of a WhatsApp or Telegram group where all employees can chat and discuss. A few weeks before the expected renovation of the contract, a worker writes that he is seriously ill and that his health condition will likely deteriorate in the coming months. A co-worker forwards this message to the employer.

2. A college female student sends an intimate video to her boyfriend, who studies at the same university, for his birthday. However, after some weeks, she decides to end the relationship. In retaliation, he shares her video with all his male friends and colleagues.

Both cases have at least two elements in common. First, personal information has been disclosed voluntarily by the senders. However, it does not take a lot of mental gymnastics to feel there was an injustice committed. The employer, supposing that they decide not to renovate the contract, may be sentenced to pay compensation to the worker, unless they prove the decision was justified by other reasons. Depending on the country where they live, the ex-boyfriend may be prosecuted and sentenced to compensate the victim—but what if all the recipients of the video keep the secret and do not report it to the girl or the college authorities?

We argue that design should bring solutions to the table. In both cases, the sharing of personal information has been made possible by designed services. Hence, it is the duty of designers and developers to incorporate features that limit the risks of misuses of personal data by the recipients. For example, by allowing people to cancel the information once it has been sent, or to prevent the recipient from sharing messages with third parties.

3.1 WhatsApp's Privacy Features

WhatsApp allows users to send end-to-end encrypted messages and to make encrypted calls through the phone's Internet connection.[8] Users can also share photos, videos, audios, documents, and create (and become members of) groups with up to 256 people. Encryption is intended to protect the content sent by users from external tampering but does not prevent abuses by intended recipients of the communication. The app offers some tools to mitigate such risks. Users can send photos and videos that disappear from WhatsApp chat after the recipient has opened them once, and these media will not be saved in the recipient's photo or gallery folder. However, this feature does not prevent the receiver from taking a screenshot of the message or making a screen recording—in this case, the sender will not be notified. Furthermore, this feature does not work for texts.

After the "view once' media file has been sent, the sender will not be able to see it in the chat. The sender and the receiver cannot forward, save, star, or share it. In our examples above, this feature will not be effective to protect the ill worker, but

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[8] Our analysis is based on the most recent version of WhatsApp for iOS devices available at the time of writing (version 2.21.243.1).

Fig. 4 WhatsApp users can send media that disappear after viewing
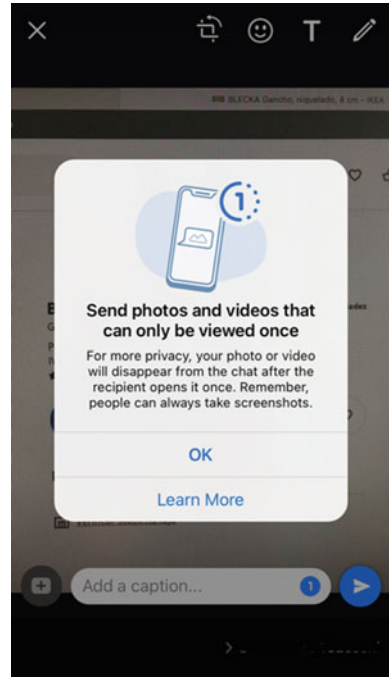
it could have prevented the sharing of the female college student's video,[9] had she used this possibility offered by WhatsApp (Fig. 4).

Group chats include the Disappearing Messages feature: any group participant—unless the group administrator determined that only admins are permitted to turn it on or off—can set every message to disappear from the chat for everyone after 24 h, 7 days, or 90 days. Again, disappearing messages can be recorded by group members and can be forwarded to third parties, limiting the intended privacy protection scope of the tool (Fig. 5).

Similarly, WhatsApp users can schedule a Default Message Timer of 24 h, 7 days, or 90 days. When enabled, all messages in new individual chats will disappear after the selected duration. However, when a user replies to a disappearing message, the quoted text may remain in the chat after the selected duration. Disappearing messages can be freely forwarded to third parties and, were they to be forwarded to a chat with disappearing messages off, they will not disappear in the forwarded chat. WhatsApp suggests using the feature only with trusted individuals, for forwarding and

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[9] Or at least limited its impact in case the boyfriend had recorded a video of the intimate film sent by his girlfriend using a recording device, with the consequent loss of image quality. However, nothing could prevent a potential damage to the student's reputation, were her partner to be a tech-savvy person familiar with screen recording tools.

Fig. 5 Users and admins
can make messages in group
chats disappear after a
selected duration
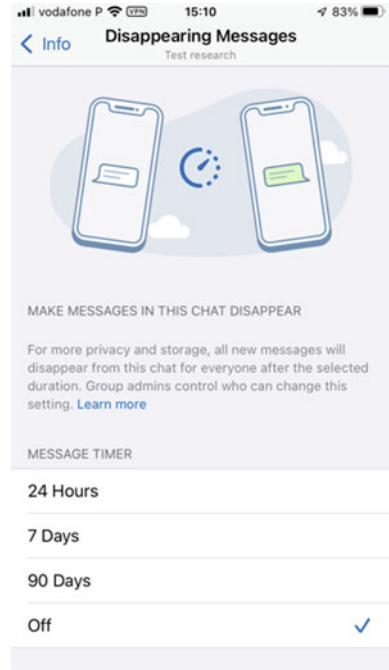
taking screenshot remains possible, as well as copying and saving content before it disappears, and taking a picture of a disappearing message with a camera (Fig. 6).[10]

In conclusion, the tools offered by WhatsApp to protect users' privacy against information abuses by other users is quite limited in scope and effectiveness. The Disappearing Messages feature could not efficiently protect the worker's sensitive information, for it does not impede forwarding messages. Similarly, the reputation and psychological integrity of the female college student would be in jeopardy, had she used WhatsApp to send intimate videos to her partner.

3.2   Telegram: Privacy Design Features

Telegram allows users to send messages, share files, and make end-to-end voice and video calls through the phone's Internet connection. Security is based on the MTProto protocol.[11] Private and group chats (of up to 200.000 members) are protected through server-client encryption. An additional layer of two-way encryption is used for secret

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[10] Source: https://faq.whatsapp.com/general/chats/about-disappearing-messages/?lang=en   (last accessed: 2 February 2022).

[11] We analyzed the most recent version of Telegram for iOS available at the time of writing (version 8.4.1).

Fig. 6 Disappearing messages work in individual and group chats
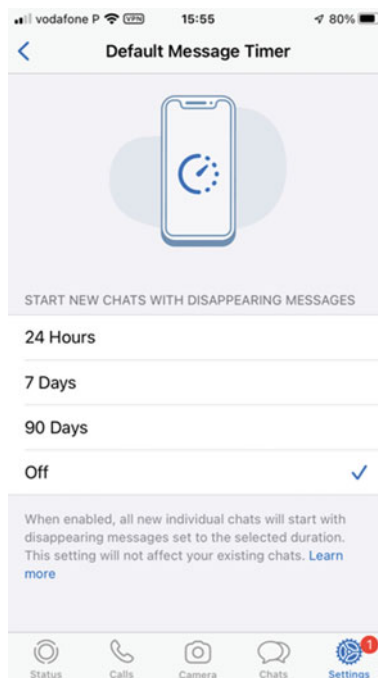
chats, that are device-specific and are not part of the Telegram cloud, like non-secret chats.

Telegram offers several tools to protect users' privacy and content confidentiality. In this section, we will go through the features that Telegram released since 2013, starting with non-secret chats. As with WhatsApp, in Telegram users can set messages to auto-delete for everyone after a period of one day, one week, or one month. This feature is available in individual chats and in groups and channels[12] where the user is an administrator (Fig. 7).

A more effective feature to protect privacy and confidentiality allows users to delete messages for everyone after they have been sent, both in individual and group chats. Users who regret the messages or files they have sent can decide to cancel them for everyone. Following such action, deleted messages will simply disappear from the chat (Fig. 8).

This feature, which is unavailable for WhatsApp users, is quite beneficial for users' privacy. In our examples, it could have avoided harm to both the ill worker and the female college student, had they deleted the messages for everybody *before* they were forwarded to third parties by the recipient. Moreover, Telegram offers an interesting feature that restricts the ability to forward messages in groups (and channels). The

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[12] Telegram channels allow users to broadcast messages to unlimited audiences. For this research, we analyzed only the features available for individual and group chats.
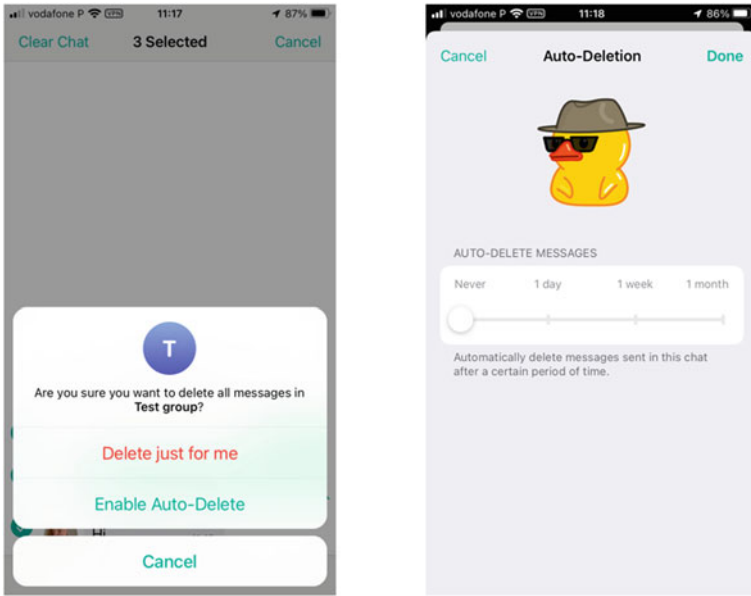
Fig. 7 In group chats only admins can enable the auto-delete messages tools
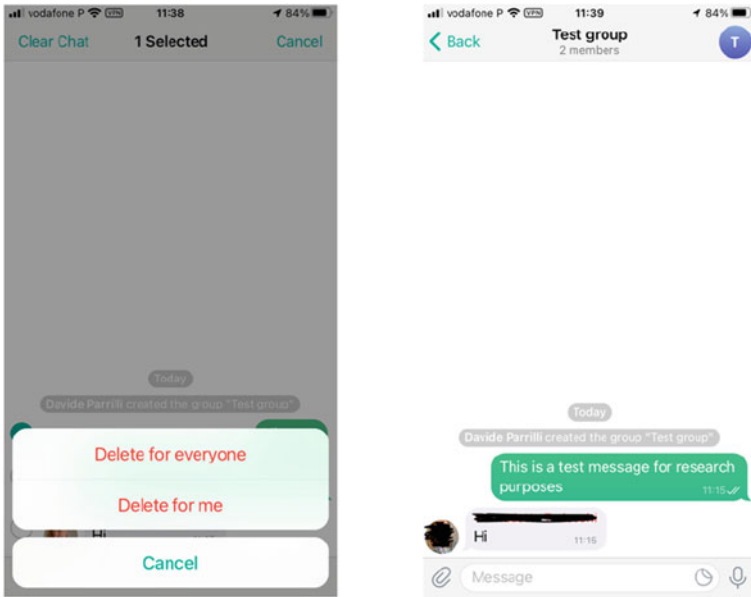
Fig. 8 If a user decides to delete messages, media, or files for everyone, they will disappear for everyone
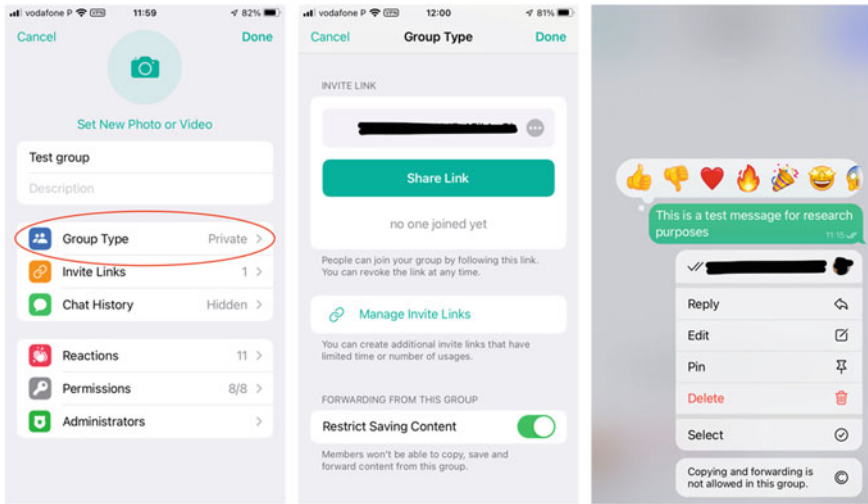
Fig. 9 Group admins can prevent all users from copying, saving, and forwarding messages

admin can turn on the Restrict Saving Content slider to prevent all group members from copying, saving, and forwarding messages from the group (Fig. 9).

The Restrict Saving Content feature is particularly powerful to prevent users from taking screenshots. More precisely, users are allowed to take screenshots, but the images in the chat will not be recorded in the screenshot picture. Surprisingly, however, texts and videos are fully registered in the screenshot (Fig. 10).

We tested what happens when the recipient of texts and media in a chat with "Restrict Saving Content" is activated tries to record the screen of their device.[13] The results of the test are perplexing.

1. If one tries to start screen recording when the Telegram app and the chat are both open, it is not possible to record the screen—the app we used simply did not open.
2. When the Telegram app was open, but the chat to be recorded was not, the screen recording app turned on and worked correctly, but it did not record the content of the chat.
3. When the Telegram app was not open, the screen recording app recorded all the content in the chat, including media (Fig. 11).

It would be interesting to see if this feature is improved in the next versions of the app. If fully developed, Restrict Saving Content can effectively protect the privacy and confidentiality of messages and files exchanged in a group chat. If text messages could not be recorded in screenshots, the ill worker in our example would have been able to share sensitive information with colleagues with more confidence. Group

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[13] We used for the test the native screen recording app in iOS.
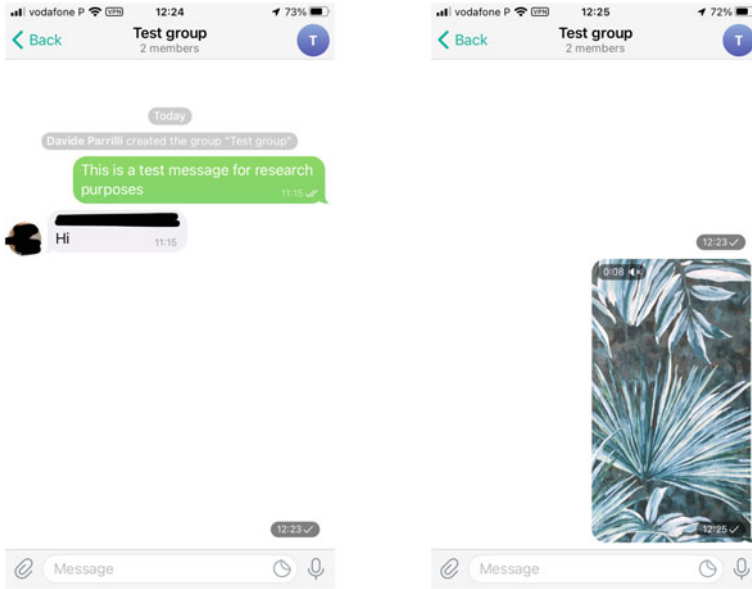
Fig. 10 Videos are registered in screenshots (image on the right), unlike pictures (on the left)
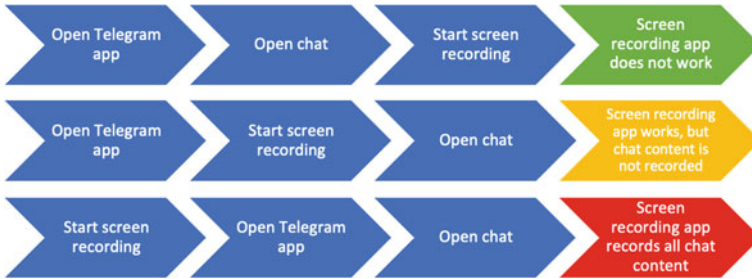
Fig. 11 Diagram of actions and outcomes of our test

chats could be used by lovers to share intimate images and pictures—and, more broadly, by users to send medical information and other sensitive documents.

In case of forwarded messages, Telegram allows users to remove the original sender's name before forwarding. However, only the recipient of the message can decide to protect the identity of the sender. Finally, users have the possibility to protect the confidentiality of the content included in a text message by using the ||text|| formatting. The message will appear to both the sender and receiver as hidden text. Tapping the spoiler animation in chat allows reading the content of the message. The text is hidden also in the chat list and notifications, as well as when it is forwarded to another user. However, information confidentiality is potentially threatened by the possibility to take a screenshot of the text, while it is still readable (Fig. 12).
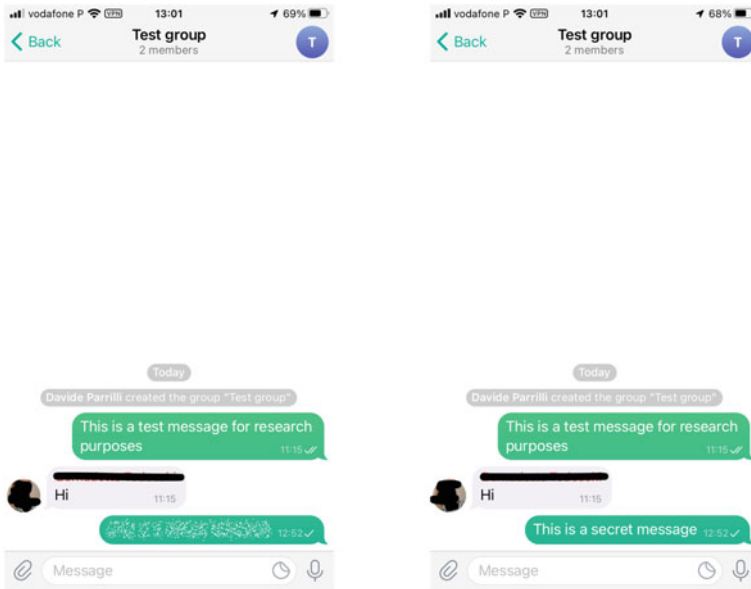
Fig. 12 The privacy of secret messages is jeopardized by the possibility to take screenshots

Secret chats add an extra layer of security and information protection. Users of secret chats can assign a self-destruction timer to their messages that will delete them after the selected period (which ranges from one second to one week) once the message is displayed on the recipient's screen. Messages from secret chats cannot be forwarded, and when a message is deleted on one side of the chat, it will be also deleted in the receiver's end.

If the receiver takes a screenshot, a notification is sent, and it appears in both chats. We tested this feature by taking screenshots and recording the screen. All parties have been always correctly notified, and we noticed that in case of screenshot pictures sent in the chat are not recorded (like in the left image in Fig. 10), unlike videos and texts. When we tried to record the screen, we obtained inconsistent results. In most attempts, we could not record the screen if the secret chat or the app were not open when the screen recording started. However, on one occasion the screen recording software used for the test managed to record the video sent on the secret chat. Furthermore, if the video in the chat was playing when the screen recording started, we were able to record the first frames of the video in the chat before a fixed frame was registered instead. Interestingly, Telegram acknowledges on its website that "there is no bulletproof way of detecting screenshots on certain systems" and "it may still be possible to bypass such notifications and take screenshots silently".[14]

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[14] Source: https://telegram.org/faq#q-can-i-be-certain-that-my-conversation-partner-doesn-39t-take-a (last access: 28 January 2022).

Videos sent in secret chats cannot be forwarded or saved. However, images and texts can be copied and saved.

The overview of the Telegram features reveals that the Russian-made messaging app is more apt than WhatsApp to safeguard users' privacy through confidentiality. Telegram offers more tools that its rival, and it implemented features to limit the misuse of sent information by restricting copying, forwarding, and saving content. However, such features are still embryonal and should be further developed. In particular, the fact that Restrict Saving Content allows messages, including videos and pictures, to be registered in screenshots and records of the screen is particularly worrying. In both examples, users such as the disloyal coworker and the coward boyfriend could have accomplished their goals due to the app's existing loopholes.

Secret chat offers more privacy and confidentiality, but the fact that it cannot be accessed from other devices makes it quite unpractical. However, it is surely a useful tool for users who give priority to information protection rather than usability. Further, our test revealed some issues when recording the chat, that led to inconsistent results. We hope and expect that the next app releases will increase privacy and stability.

4 Conclusions

Privacy infringements by users can have serious consequences. In the previous sections we showed that people could lose their job, reputation, self-esteem—and, in extreme cases, their life—when other end-users misuse their personal information. Legislation can be effective in preventing such abuses through the fear of sanctions for infringers. However, sanctions are imposed only after the malicious abuse took place. We advocate that design is better positioned to effectively empower consumers of messaging apps to protect their personal information. Communication platforms should be designed to allow users to delete their messages for everybody after they have been sent—Telegram deserves praise in this respect—and to effectively impede recipients from forwarding, screenshotting, or video recording the sent text and media.

Both WhatsApp and Telegram have many things to improve, both from the design and technical points of view, to ensure that users have full information control. The point is that when users disclaim personal information to one or more recipients through a messaging service, they can trust that neither the service nor the people receiving their messages will not misuse the information. In other words, the traditional pattern of interpersonal offline communication has been replicated online, but with a major difference: the possibility to record, forward, and spread the information shared. Trust is not enough to protect the confidentiality of online conversations: the sender must also have adequate mechanisms to control the information once it leaves their hands.

In the next steps of our research, we will investigate how design can effectively allow users to control their data. We will propose how existing tools, such as those described in this paper, can be further developed and improved, including from the

perspective of User Experience and usability. But, more important, we will speculate with possible future scenarios where users, through technology, will have the power to fully control their information. Speculation in design is a powerful tool to delineate alternative scenarios [32]. Starting from potential imagined solutions, we will investigate how to make them plausible and, ultimately, possible. Technology is advanced enough to allow massive facial recognition or to predict users' behavioral patterns. Our ambition is to show that technologies often used for surveillance and profit can be used for ethical purposes too. We envision technologies that not only respect users' privacy, but that augment it. Design and technology that protect fundamental values such as dignity, self-esteem, and the right to live a life without the fear of being judged or abused by somebody known or unknown.

The ultimate scope of our research is to fully realize the potential of human-centered design, whose real mission is to affirm, support, and strengthen human dignity [33], not only against governments and big corporations, but also against threats posed by other users.

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Research Methods and Strategies

Design Radicalized as Experience: Disentangling and Reassembling the Dance Floor Experience to Understand the Relationship Between Design and Clubbing

César Lugo-Elías and **Pedro Cardoso**

Abstract Using data gathered by means of participatory observation and in-depth interviews conducted over two years of fieldwork in a club devoted to after-parties, the present text examines (a) the elements within a club of house music; (b) the way these elements interplay among them in the design and creations of the dance floor experience; and (c) how Design transcends the physical constrain of objects to be radicalized as experience in this context. The aim of this text is to open a discussion about the capacities of Design to trigger emotions and organize interpersonal interactions using the dance floor experience as a case study. This study accompanies the increasing scholar interest in the relation of Design and clubbing, while presenting data gathered through first-hand experiences, helping to close the gap in Design literature regarding clubbing, which tend to use data from secondary sources.

Keywords Lottus After-Hours · Dance floor · Design · Experience · Urban Ethnography

1 Intro: Stories from the Dance Floor

This text uses data from a doctoral research conducted at the *Lottus After-Hours* [1], a club devoted to house music in the city of Porto, Portugal. For this research, data was gathered using participatory observations and in-depth interviews. The period of data gathering took ca. two years, between 2016 and 2018. The focus of the observations was on the material and technological elements involved in the creation of the dance floor's environment, the interactions among the participants of the experience; and the DJ performance. The observations aimed to understand how site-specific the dance floor experience is. In simpler terms, and from a *material*

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perspective, we wanted to understand: *why is this experience happening here and not somewhere else?* As a result of these observations, the focus of the research shifted towards the DJ performance as a gateway to understand the different elements of the experience and the way such elements interrelate. The rationale behind this was our understanding about how music is customized by the DJ to the venue, technical equipment, time, vibe, and to interpersonal interactions occurring in the dance floor during the performance. It is important to underline that this is not a study about DJing, but for this study, the DJ performance became an entry point to *disentangle* the complexity of the dance floor experience.

During the participatory observation, the corresponding author played the roles of doorman, dancer, and DJ, developing expertise and creating rapport with ten DJs who voluntarily accepted to be interviewed. All interviews were conducted under the condition of anonymity; therefore, DJs are named using a code and cannot be identified here nor in the original work. The transcription of the interviews was coded following the guidelines of [2] to conduct thematic analysis, approaching coding in an inductive manner, meaning, acknowledging coding as an active process and fundamentally an act of interpretation, resulting in the constant selecting, naming, discarding, arranging, and hierarchical grouping of themes and subthemes.

As a result of that analysis, seven themes were created corresponding to seven basic elements constituting the dance floor experience: *music, venue, audience, abilities, enthusiasm, stances,* and *journey.* These themes are explained in Sect. 2 of this text; followed by Sect. 3, where those elements are presented as part of four assemblages, the *material*, *social*, *performative,* and *experiential* assemblages, creating a theoretical framework to understand how the dance floor experience can be designed from the seven initial elements.

A fourth section contrasts this information with the concept of *allatonceness* [3], suggesting that the role of Design in the creation of the dance floor experience goes beyond placing physical objects within the interior space of the club. Through Design, clubs allow interactions among the material, social and performative aspects, constituting the dance floor experience. In other words, we suggest that at the dance floor, the potential of Design transcends the physical constrains of objects and products to get radicalized as the embodied clubbing experience.

2 Clearing the Mess: Disentangling the Dance Floor Experience

This section summarizes seven thematic maps, one for each element identified as part of the dance floor experience: *music, venue, audience, enthusiasm, abilities, stances,* and *journey* (see Fig. 1).

Music. Music can be seen as a mean to *trigger emotions* and to *match scenarios* during the dance floor experience. This became evident when analyzing some of the labels DJs use to name and organize their extensive digital music collections. DJ3
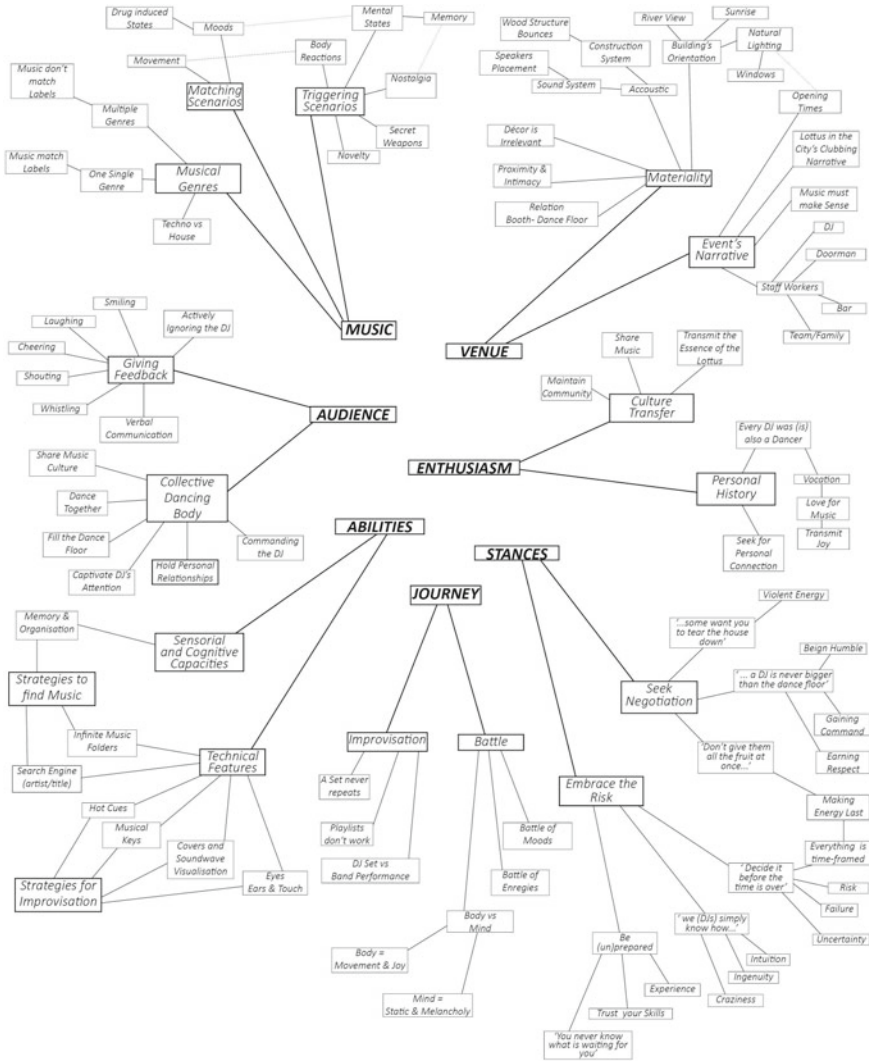
Fig. 1 General view of the seven thematic maps—*music, venue, audience, enthusiasm, abilities, stances,* and *journey*—with their respective subthemes

reports saving his music folders named for example: *zombiness* (sic.), *continuous groove*, *enders*, *everybody is dead*, and *strange noises*. DJ1 also reports having a folder of music called "*weird beats bar MDMA* [weirdbeats_MDMA]" containing music he uses when people are "completely out-spaced". The use of these labels reveals much of the energy contained in music, but also some of the scenarios DJs will find at the dance floor.

When used as a *trigger*, music becomes the main input to the dance floor experience, provoking bodily dance movements, evoking emotions, synchronizing the general mood, and preventing negative scenarios—i.e., boredom, monotony. Two good examples of this, is the use of novelty and nostalgia [4]. Novelty is used when DJs play new tracks, triggering curiosity and enthusiasm in the audience. Nostalgia is triggered by bringing back memories to the audience by selecting recognizable themes during the DJ performance, as DJ2 describes: "That happens to me often when I play *Forever More*,[1] I always feel the reciprocity from the public with those classics, like *I've got The Power*[2]".

Music, and the subjective aesthetic information contained in it, is then used to create a stream of energy above the dance floor, while offering accents of nostalgia, joy, novelty, engagement, and the maintenance of emotional mental states. Music, or the centrality of music, is also in constant flow between the foreground—as a trigger of experiences, and the background—as the sonic context of those experiences. As music interplays between the back and foreground, other elements get the chance to take a central role and protagonism in the dance floor, like the audience or the material context, showing how crucial is the interplay between different factors in the creation of the experience.

Venue. Venue focuses on the intersection between two sub-themes, the *event's narrative,* and the *materiality* of the club. The *event's narrative* answers three general questions: *When is the event occurring? Who is attending? What kind of music is being played?* On the other side, *materiality* includes all tangible, visible, audible, and haptic objects or *things* found within the dance floor, including light, room temperature, construction materials, decoration, objects such as clothes and fashion accessories. This map suggests that the combination of these two subthemes modulates the mood of the audience, and the activities carried out on the dance floor.

Having the Lottus as our venue, the narrative is that the doors open at 6:00 am, holding diurnal afterparties instead of night events. This club receives clients coming from other clubs and events, not necessarily linked to the scene of house music, creating a mixed audience—mostly male, though—with different ages, musical backgrounds, sexual orientation, and sartorial tastes.

To these factors, we must add the material elements present at this venue, like the entrance of sunlight trough two windows flanking the DJ booth—the central visual point of the dance floor—provoking gradual changes of light and temperature following the natural movement of the sun. The conjunction of these elements, the natural and the architectural element of the windows and the orientation of the venue towards the river, creates a diurnal narrative of relaxation, facilitating the communication among DJs and audience, helping to build a more cohesive audience. This creates a contrast with the narratives of anonymity and indulgence produced by the darkness of night clubs. Natural light remembers that the time of the night has passed, placing the audience narratively and physically in the *after* party. Similarly,

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[1] A musical theme released in 2003 by *Moloko*.

[2] The correct name of this theme is *The Power*, and it was released in 1990 by *Snap*!

the musical selection of the DJs follows a day-night narrative, reserving techno for the night and house music for the diurnal after hours.

Another way in which the *materiality* and the *venue's narrative* regulate each other, is through the disposition of the audience at the dance floor, facing the DJ while being surrounded by the sound system. This facilitates the effect of reverberation, which is produced when the sound waves coming from the speakers spread in the physical space of the dance floor, impacting both bodies and objects, especially walls. Once this occurs, some of the energy contained in the sound waves will be absorbed by the impacted objects, while other frequencies will bounce back into the atmosphere of the dance floor creating a series of audible echoes and atmospheric vibrations [5, pp. 109–110]. Much of this reverberation is registered as vibrations on the very skin of the audience. Reverberation allows the physical connection between architecture, music, and audience, and was also observed by [6] as an element capable of organizing the space by creating *walls of sound*.

Additionally, the timber structure of the dance floor at the Lottus creates an unexpected effect of bouncing as the audience dance to the pace of the house music making the floor vibrate. This is perceived by the DJs as a form of feedback from the dance floor—s. next section *audience*. In this way, the venue facilitates the intense experience trough visual, haptic, and sonic inputs, regulated by cables, speakers, sound system, physical distance, the always changing sunlight, and acoustic reverberation.

Audience. The audience has two main forms of influencing the general dance floor experience, one is by becoming a *single collective dancing body*, and by giving *feedback* to the DJ. Dancing is the main social activity at the dance floor, and DJs visualize audience not as individuals dancing separately but as a single collective dancing body, as DJ1 puts it: "I try not to see much after specific persons on the dance floor, I try to observe the dance floor as a global image … as a blurred image, I try to see the global view". Individual key dancers [7] became less relevant, as the goal of the DJ and audience is to achieve synchronicity and communality under a similar vibe, using dancing as both communication tool and as a means of embodiment of the experience. Audience also expresses feedback verbally—by yelling, whistling, cheering—with hand and facial expressions—smiling, starring, clapping, nodding—and by social interaction—greeting, inviting/sharing drinks or cigarettes, and by holding a welcoming stance to each other's way of dancing and activities, avoiding judgmental positions.

The complementary roles of the audience as collective dancing body, and as sending feedback to the DJ—who ideally will interpret it and include it in the musical decision process—creates a circuit we describe as a *feedback machine*, capable to mediate between at least two types of energies present in the dance floor: the sonic energy contained in the music and the kinetic energy contained in the act of dancing [8, p. 41]. The theme of the audience then incorporates the sum of the embodied and objectified movements, gestures, whistles, verbal and facial expressions, floor vibrations, and triggered emotions accomplishing a mutual *aesthetic understanding* [6, p. 19] between the DJ and the dancers.

Abilities. Admitting that the feedback from the audience cannot be fully predicable, DJs develop abilities of *improvisation* and to *find music* during their performance. This requires the use of their sensorial and cognitive capacities in combination with the technical features of the DJing equipment. Regarding the sensorial and cognitive capacities, these come to help when DJs must shift focus during their performance among four aspects: (1) the music track playing in the moment; (2) the selection of the upcoming track; (3) the interactions and reactions of the audience; and (4) the manipulation of the DJ equipment. To manage these tasks, DJs use one headphone to listen the new track, the bare ear to hear the track currently playing through the sound system, while watching the reaction of the dance floor without holding any specific focal point—applying a high degree of spatial memory to manipulate the music equipment usually without seeing it.[3] These capacities are applied in conjunction with the technical features offered by the DJ equipment, creating strategies to quickly select and find music during the DJ performance. These strategies include the use of customized labels for music and the use of the search engine to find those labels during the performance; the same search engine can also be used to quickly find a track by typing the first letter of the authors name, album or song title; also, some equipment like the CDJ and laptops offer the possibility to visualize album covers, which comes to help when trying to remember a single track's name among the extensive DJ's music collections.

Another possibility offered by the equipment is the use of hot cues. Hot cues are digital flags or marks a DJ can *place* strategically in certain moments of the track, for example to mark the beginning of a specific melody or vocal phrases in the music. These marks are *recorded* in the digital track, *remembered,* and visualized in many CDJs and DJing software. In this way, the DJ can quickly start a track at a specific point, saving time to find that spot.[4]

Combining the technical features offered by the equipment with their cognitive capacities, DJs can dissect, label, manipulate, and find music. This translates into musical choices and improvisation strategies that attempt to match the vibe on the dance floor as well as to trigger reactions and emotions. DJing is then an excellent example of how the combination of technology and human ingenuity don't create automatization but facilitates human improvisation, echoing [9] notion that improvisation assisted by technology does not mean the loss of human agency but its complementation.

Enthusiasm. DJs add value to their performance not only by mastering new DJing techniques, acquiring DJ devices and software, or by collecting large music collections; additionally, they bring an attitude of respect and dedication towards their craft. This enthusiasm reflects their personal history and artistic and creative motivations, as well as the self-perception as cultural keepers capable of transfer club culture.

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[3] This can be compared to a person playing video games who is capable to focus on the screen and not on the controllers or the equipment.

[4] Digital hot cues have their analogue precedent in vinyl records, where DJs used wax crayons to draw a mark on the disc's surface, recording specific spots where they should place the needle of the turntable to find musical sections.

As part of their personal history, DJing is seen as second nature, a vocation they start discovering mainly during their past role as dancers and influenced by peers and family members:

> DJ7: [I had musical influence] from my father… I can remember when I was already 10 years old being in the car with him driving and hearing house music… that was pretty much my first memory of house music… that [music] informed my background and opened me the door for this world.

> DJ3: because being there [on the dance floor] was like being in my natural habitat, always … in those [past] years, it was common for me to wake up and go straight to the Lottus.

> DJ10: before [becoming DJ], I was always there [on the dance floor] having fun…

These experiences offered the DJs a sort of layout from which they start to develop their DJ persona. Especially the capacity of the DJ to read the audience seems to be very much influenced by their past as clubbers, underlining that every DJ may always have a past as dancer. DJs also made emphasis in their enthusiasm to transmit joy, love, and their passion for DJing:

> DJ2: I do this because I love it, I love the music, the scene, the friends, and if it weren't because of my love for it, I would not do it anymore.

> DJ4: I want to transmit happiness, joy, happiness … and dance.

Another motif mentioned by DJs is the maintenance and transference of the club culture: "There is something… how can I explain it, there is some sort of teaching … of education. I try to pass some musical culture when I am at the Lottus" (DJ2). This club culture extends to what the dance floor—including the DJ—sees, hear, feels, experience, and constitutes a sort of memory that cannot be fully recorded by text or video. By analyzing this theme, is possible to suggest that the best way to maintain and preserve club culture is by re-enacting the dance floor experience, for which the DJ performance is a central part of it, and DJs seems to be aware of it.

The enthusiasm from the DJs encircles personality traits and motivations embedded in the DJs personal biography, informing the *way* and the *why* they do their craft. They integrate their pride, knowledge, and efforts to both maintain and actualize the club culture by re-enacting the dance floor experience every morning they play at the Lottus.

Stances. Different from their enthusiasm and abilities, DJs bring certain stances that help them to negotiate with the dance floor to achieve a collective and communal experience through the manipulation of sound customized to people's mood and in concordance with the venue's narrative and materiality. These stances are to *embrace the risk of failure* and to *seek negotiation* with the dance floor, rather than imposing their musical decisions.

The *risk of failure* during the performance means the risk of misreading the audience's wishes; not bringing the right musical style; not playing the music in the right order or in an inadequate speed; or failing to create seamless musical transitions when manipulating the equipment. Any of these *failures* may result in the disruption of the vibe or energy on the dance floor. Facing all these scenarios, DJs must embrace "a good portion of uncertainty [while bringing another portion of] ingenuity,

craziness…" (DJ6). When they embrace those risks, they seem to be more open for improvisation through creative ways of manipulating the equipment, or by bringing and playing new musical tracks or mixing genres.

On the other hand, DJs *seek negotiation* by acknowledging the dance floor as a sort of *commanding entity,* understanding that "the DJ will never be bigger than the club … the dance floor commands the DJ, not the other way around" (DJ1). In this way, DJs embody a role not only as performers, but also as service providers, giving importance to be perceived as respectful of the audience but also self-assured in their craft. This helps them to deal with individuals who may bring disruptive energy by complaining about the music: "They are there expecting me to tear the house down and *pum, pum, pum!* [mimicking the sound and pace of the bass in techno and house music]" (DJ2); or by making musical requests, something that is rarely welcome by DJs since it tends to ruin the musical narrative they tend to build during the set.

Journey. Journey describes the aesthetic output generated through the DJ performance, expressed as a *battle of energies*, and *improvisation.* The term *battle* is used here to describe the antagonism created by the constant flow of energies during the performances: between nostalgia and novelty, between music for the body and music for the mind, between joy and melancholy. This creates a narrative through gradual juxtaposition of vibes, which can be contradictory:

> DJ1: [I try] to create a narrative through the response of the audience, but that is always difficult, sometimes you don't get it … but that is the fight … as I told you I try to create a *battle of energies* and maybe create some drama and then an explosion of energy … a contrast … it is a *battle of spirits*, a *battle of moods.*
>
> DJ3: A good set for me should have variety, a mix of forces, fragility, joy and even melancholy… It should have moments for everything … and it should be natural, organic. Things should not be forced; they should occur naturally.

Improvisation is understood as the lack of a defined plan for the *journey.* Everything gets solved in situ and ad momentum, just as the selection of the music occurs *on the fly.* Thanks to the array of possibilities offered by technology and the vast sonic material at their disposal, every DJ is capable to improvise in their own manner, as DJ3 states: "This is one of the things I think makes DJing harder and beautiful, there are thousands of ways for you to do things; and everyone, all DJs are doing the 'same job' but in very different ways". Embracing improvisation and the risk of failure humanize the performance adding an edge of expectation while maintaining the audience engaged during the performance.

Seen like a *journey*, the dance floor experience challenges traditional notions of displacement as DJ8 puts it: "I used to say that this is an airplane, it takes time for the airplane to completely take off, then during the flight, the aircraft will face some turbulence … and eventually [it] will land". To be in the journey means to be embarked in a sonic endeavor capable of bringing the audience to different places and moments by triggering collective emotions and organizing embodied experiences, all without leaving physically the dance floor.

3 Building a Philosophical Framework: Reassembling the Dance Floor Experience

After analyzing the different components of the dance floor, it was necessary to analyze how they interplay, creating the *gestalt* or their articulation that is more than the sum of their parts. To achieve this, we organized the themes into four assemblages: the *material*, the *social*, the *performative*, and the *experiential* assemblages.

The Material Assemblage. So far, the elements capable to mediate among the different material elements involved in the creation of the dance floor experience are *sound*, *reverberation*, *proximity*, *emptiness*, and *light and darkness.*

Sound. Sound is encoded as a continuous groove engraved on the surface of the vinyl records, or coded as *zeros* and *ones* recorded in music digital formats. For the sound to be released, it is necessary the interplay between the technical features offered by the DJ equipment—which will decode and playback the sound—as well as the cognitive and sensorial capacities of the DJ—who will release the sound following the feedback he/she reads from the audience according with the subjective energy contained in each musical track. Then, the sound will be emitted through the sound system—cables and speakers—into the physical space of the dance floor as soundwaves. These waves will be perceived not only as music but as variations in the atmospheric pressure hitting the skin of the audience, and as reverberation, impacting both individuals and the architecture of the dance floor.

Reverberation. Reverberation is not only the consequence of the sound waves hitting the architecture of the dance floor, but a medium for the sonic energy to circulate between and *through* the bodies of the audience. As such, sound is finally translated into body movements. As movement, sound will be re-transmitted back into the materiality of the dance floor by the effect of bouncing produced by the dancers when hitting the floor; this *bouncing* is then perceived again by the DJ, creating a closed circuit or a *feedback machine.* Since the sound of house and techno music follows a 4/4 signature, it helps to synchronize the people's movements—the *collective dancing body*—with the architectonic reverberation. This synchronicity can be expressed using the onomatopoeic form *pum*, *pum*, *pum*, *pum*, to describe the pace in which music, architecture, and people's movement gets coordinated, creating a specific synchronicity. By coordinating all these elements, sound is probably the most notorious mediator in the creation of the dance floor experience.

Physical proximity. The material assemblage is also influenced by other design elements such as the *physical proximity* between the DJ booth and the audience. As in the Lottus—where the DJ booth is situated at the same level as the dance floor while surrounded by the audience—DJ and audience can share a single common sonic experience, facilitating the necessary empathy to create the flow of sonic energy between the DJ booth and the dance floor.

Emptiness. Emptiness is another fundamental design element in the creation of the dance floor experience. Rather than being seen as a negative aspect or as *lack of design*, the emptiness of the dance floor is a conscious design decision which suggests and allows dancing, transit, interactions, and the propagation of sound. Emptiness

organizes the dance floor experience not by signifying what to do within the space, but by allowing things to happen while offering the necessary space for the embodiment of sound. *Empty* is also an adjective applicable to the walls of the dance floor at the Lottus, which lack of decorative elements. The walls, ceilings and floors are either painted in plain dark color or exposing the raw construction materials—rocks on two walls, and timber in floor and ceiling. These elements, just as emptiness and darkness, evoke an aesthetic narrative of the *provisional*, the *possible*, the *emerging* [10, p. 118] in concordance with the egalitarian narratives of the collective dancing body who moves synchronized by the sound of house music.

Light and Darkness. In a similar way, *lighting* and, maybe more surprisingly, *darkness* are key elements in the design of the atmosphere within the dance floor. While in the nightclub darkness may allow anonymity as well as indulgent sexual, sensual and drug practices; at the Lottus, darkness is occurring only in the beginning of the event, as later the place is bathed with sunlight as a new day develops. These change in light between night and day is essential to the construction of the event's narrative influencing the way people interact with each other. Once the sun overflows the dance floor, illuminating and heating the atmosphere, individuals and actions become visible, people tend to recognize themselves while sharing the same experience without the need of anonymity. As one attendee at the Lottus once commented: "every time I see the sun coming into the dance floor, I always think: *we made it*".

The Social Assemblage. The social assemblage is mediated by *interaction cues* and *social energy*.

Interaction cues. The most notorious interaction cue is the collective act of dancing, which encircles all forms of embodiment such as body language, body movement and facial expressions. Other interaction cues are the feedback used by the audience to express approval or disapproval, including verbal conversations, laughter, cheering and even the act of dancing to music with closed eyes as a way of introspection. These are all forms of feedback influencing the dance floor experience.

Social energy. DJs foster the sonic energy contained in music to be translated not only into interactions but also into sensations and emotions such as joy, empathy, euphoria, looseness, nostalgia, and curiosity. This energy is achieved by manipulating the DJ equipment, capable to playback, label, dissect, loop, equalize or increase and decrease the speed of music. Through the manipulation of sonic means, sound translates into mood or vibe, resuming the emotional load and *social energy* of the dance floor experience.

The Performative Assemblage. The performative aspect of the dance floor experience is mediated by *sonic cues* and the *cultural ethos* or cultural narrative. While *sonic cues* help in the customization of the sonic energy of the experience to the wishes of the audience, the *cultural ethos* helps to wrap that experience in a single subjective cultural narrative.

Sonic Cues. Sonic cues are here all those sound signals, melodies, patterns, rhythms, and breaks encoded in the musical tracks, which will be released by the DJ in combination with the technological features of the equipment and following the

feedback of the public, who will again decipher them and translate them into movement, interactions, emotions and finally record them as memories. A good example of this is the use of the so-called *hot cues* recorded in digital music. These digital tags help dissect and mark the beginning or the end of certain music sections. This makes possible for DJs to navigate through the structure of a musical track. Hot cues help find the right sonic energy the audience need by marking certain *sonic cues* like melodies, vocals or characteristic sound embedded in music.

Cultural Ethos. Cultural ethos is an umbrella concept covering all the different aspects related to the dance floor culture, being ideas of utopian egalitarianism, political manifestations, relations of power, as well as empowerment of minorities and the exploration of the own personality. The cultural ethos of the dance floor experience contains all these elements rendered as sonic cues, technical equipment, human interaction, material spaces, DJing techniques and different types of embodiments and communication—like dancing and cheering. All these manifestations are all occurring simultaneously within the physical space of the dance floor creating a cultural narrative.

The Experiential Assemblage. The last assemblage suggests that the dance floor experience is the gestalt of all the moments, interactions, emotions, materials, equipment, sounds, body movements, and performative and cultural aspects manifested during the dance floor experience. This assemblage considers all other three assemblages as sources of aesthetic knowledge, which will be interconnected trough the experience itself. Like so, and paraphrasing [11], each element becomes a medium, influencing and transmitting agency to the other (p. 17) until the whole experience is assembled. This reinforce the idea of the nightclub as a " *Gesamtkunstwerk* melting interior and furniture design, graphics and art, light andmusic, fashion and performance into a unique whole" [12, p. 10].

Here, it seems clear that the human body is the only element capable to assemble the dance floor experience, since the human body is the repository of the experience [6, p. 4] and not the architecture, technology, nor music. The body will carry then the sensations and traces produced by the dance floor experience understood as a sonic-corporeal-architectonic dialogue.

4   Outro: Design Radicalized as Experience

Up until now, we examined the dance floor experience dividing it in 7 themes with their respective sub-themes, and afterwards we described how these elements interplay, forming the material, social, performative, and experiential assemblages that constituting the dance floor experience. In this final section, we explore the relevance that the study of the dance floor experience at the Lottus can have to for the discipline of Design.

To assemble the dance floor experience at the Lottus implies that multiple and simultaneous narratives coexist within the same space-event. This reminds to Andy

Warhol's events, the Exploding Plastic Inevitable or EPI, held at the Dom in New York in the late 1960s, which later became the club called Electric Circus [10, 13, 14]. During every EPI, Warhol activated an arsenal of projection and sound technologies, concurring simultaneously with music and artistic performances and the use of props [14, p. 81]. The (ab)use of multiple technologies and performances undertook by Warhol built a technology-based space [15] without even building or touching a single wall, but by creating a semi-solid environment while abducting the attendees into an intense sensory stimulation just as in the contemporary night-club (p. 518).

There are other references about similar multimedia environments from the late 1960s, namely the club *Maddox* in Platja d'Aro, near Barcelona [16] and the Cerebrum in New York [17]—the latter made with the intention of recreating a psychedelic trip through a multisensory environment (p. 150). However, despite these other examples, the EPI became relevant as it was used as inspiration by McLuhan's [3] to coin the term *allatoncenes* (all-at-once-ness), a concept fitting to describe our contemporary electronically-configured world, where, paraphrasing the author, information pours upon us constantly, continuously and always replaced by newer information, melting our experiences and our environment in a constant interplay, vanishing time and ceasing space into a simultaneous happening (p. 63).

Allatonceness can be seen as a strategy in the design of the club experience [18], where sound, music and media technologies create a hybrid space-event where time ceases, and space becomes indistinguishable from the events occurred there. As [16] pointed out, the club is a *phenomenological-spatial apparatus*, blending space, time, social and performative components, transforming the club from a container of events into the event itself (p. 132). This means that at the club, the category of space is no longer a stable and Cartesian. Space depends on the events occurred there, rendering technology and material elements into a sensorial experience.

As [13] pointed out, Warhol's EPI was not conceptualized as an artistic performance but as *architecture radicalized as medium,* where technology was used to squeeze out the empty space, only to be replaced with a media-based environment (p. 100). By echoing Lavin's notions, it is possible to suggest that the experience at the dance floor at the Lottus can be seen as the *radicalization of design as experience,* not by building specific environments trough decoration or by placing specific objects within the dance floor, but by using intangible design elements such as sound, reverberation, darkness or emptiness, with the aim of allowing and triggering social interactions and organizing the sonic, social and kinetic energy, characteristic of the dance floor experience. Following this line of thought, the relationship of Design and clubbing is not based exclusively in the physical objects placed within the dance floor, but in the way Design allows the assemblage of material, social and performative elements, providing for the creation of an experience rather than an object or product.

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A Case Study of Remote User Research with Older Adults During Lockdown: Analysis of Barriers, Strategies and of Communication Issues

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Abstract The COVID-19 pandemic and associated lockdowns have brought to researchers' attention the need to adapt user research methods to remote settings. This paper builds on a video dataset of remote user research with older adults, implemented in the context of a longitudinal study impacted by the lockdown. In the analysis of the dataset as a case study, we found and categorised general barriers, strategies and specificities of communication of user research sessions conducted remotely. Our findings inform researchers planning and implementing similar methods, particularly in studies involving older user groups.

Keywords Remote user research · Older adults · Video analysis

1 Introduction

Understanding users' behaviour in time is increasingly important in design research, especially when studying digital technology which changes at a rapid pace, along with users' digital literacy [1]. However, implementing longitudinal studies comes with its own set of challenges such as recruiting and retaining participants [2] or analysing longitudinal data [3]. When such studies include or are centred on specific audiences such as older adults, their specific characteristics need to be considered since they can affect how the study is prepared, implemented or finished [4]. Despite how much effort is put into planning a longitudinal study, there are always unforeseen circumstances that can jeopardize its successful completion.

The impact of the COVID-19 pandemic outbreak is particularly hard to overcome due to the imposed restrictions that included national lockdowns and physical distancing. The measures required prompt and full re-planning of many research projects, particularly ongoing longitudinal studies, to guarantee the minimum possible impact in the collected data [5]. It is also important to consider that the pandemic has taken a toll on the general population's mental health and projects

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involving older adults must consider that this audience has been especially at risk, both from the virus itself and the social restrictions that negatively impact community-dwelling and institutionalised older adults, exacerbating already prevalent issues, such as social isolation and cognitive decline [6].

At the same time, while digital technologies have been widely employed in both professional and personal contexts to communicate with co-workers, friends and family, older adults account for the lowest portion of users of these technologies. In Portugal, where our study was conducted, 76.2% of people aged 16–74 were internet users as of 2019 but, despite the increase in this number over the years, it is still below the EU-28 average. People aged 65–74 account for only 34.1% of internet users [7] indicating that navigating a remote, online environment is still not achievable for most.

We implemented a remote longitudinal study with older adults to assess if a tablet-based gaming platform could impact participants' perceived consequences of social isolation, quality of life, attitudes towards technology and cognitive abilities. The gaming platform—CogniPlay—includes 15 games developed to stimulate cognitive domains, such as visual short-term memory, arithmetic, and inferential reasoning, among others. Participants were recruited for an initial one-year period and were encouraged to continue using the system after completing this time frame.

In this paper, we share the analysis of a set of videos of remote sessions with community-dwelling and institutionalised older adults. The analysis focused on the barriers we encountered, as well on strategies that were adopted during the remote sessions. We analysed communication issues in particular, which we have found to be critical. In sharing our findings, we share lessons learned with design researchers who may find them useful to implement their own remote user research sessions.

2 Related Work

Design research with human participants requires careful consideration to ensure participants' rights are respected, their privacy and safety is guaranteed and that their well-being is promoted. Some aspects can be more easily safeguarded by procedures such as informed consent forms or study approval by institutional review boards, while others are more nuanced and require researchers to be very attentive to participants, their context, and to researchers' own actions during interactions [8].

Such design research sessions can take up different formats such as observations, interviews, focus groups or usability tests that require different degrees of interaction with users. While in some methods researchers would ideally be practically invisible to the participants (e.g., observations) in others, like interviews, the researcher takes a very active role that requires an active and extensive conversation with the user. In such cases, sessions must be carefully planned out from an interpersonal interaction point-of-view.

In this chapter, we focus on face-to-face, one-to-one conversational interactions which are an important way of gathering attitudinal, qualitative data [9], as well as

on the contributions of Psychology to the practice of design research. While listening to participants' responses is critical in conversational interactions, the interpretation of non-verbal cues such as body language, facial expressions and eye contact should not be disregarded as they can be used to enhance the researchers' understanding of what is being said [10]. While this is an advantage of this type of sessions it does not come without challenges. The researcher should consider the power dynamics at play since there could be a perceived status difference by the participants where the researcher is the subject expert potentially leaving the participant self-conscious about their knowledge [10]. Sessions should be planned to slowly introduce the participant to the subject, enabling the researcher to build trust, establish rapport and avoid surprising the participant with unexpected questions. Sensitive or difficult topics should be left towards the end of the session [11], when the participant is feeling more relaxed and at ease. Some strategies that would allow participants to achieve this state include approaching the session with a relaxed, confident and attentive demeanour, providing a comfortable environment or finding common ground with the participant in the initial stages of the session, even if resorting to some controlled off-topic conversation is required [12]. Avoiding lengthy sessions (ideally under two hours [12]) will also help control tiredness for both participants and researchers. Facilitators are, e.g., breaking complex questions into multiple simpler ones, resorting to strategies like prompts to expand on a subject or re-engaging with the session [11] and posing probing questions to uncover deeper levels or seek clarity on a subject [10]. This is particularly useful when facing monosyllabic or less engaged participants. On the contrary, participants should be allowed to talk uninterrupted and at their own pace; in case the conversation goes off-topic hindering the purpose of the interview, the researcher should then politely interrupt and guide the conversation back to the subject matter [13]. Active listening is the key role of the researcher. To indicate this attitude, the researcher can use verbal cues, by repeating or echoing what the participant is saying and non-verbal cues such as an open posture, appropriate facial expression and maintaining a good eye contact [10]. Silence, coupled with eye contact, can also be used to allow the participant time to pause and reflect [14]. The researcher conducting the session should also pay close attention to anxiety signs shown by the participant. This can derive from concerns on how they are perceived by the researcher itself or on how their responses are being evaluated [10]. It should be made clear to the participant, both verbally and through a non-judgemental behaviour of the researcher, that they are not being judged and that their participation is valued regardless of their performance.

While literature is increasingly richer in reporting the inclusion on older adults in user research, e.g., [13, 15–19], the same cannot be said when considering remote methods [20]. Both Hill et al. [21] and Loveys et al. [22] report successfully transitioning projects involving older adults to a remote setting, however neither of them employed synchronous activities with participants. Harrington et al. [23] conducted remote interviews with older adults, however their output on the application of this method is scarce, emphasizing recruitment difficulties and indicating that splitting the session in two different days allowed them to tackle technical issues more easily and avoid participants burdening. In the studies conducted by Cerna et al. [5] two

projects were switched to remote, both including older adults and synchronous activities. Throughout their adaptation, there were difficulties related to the chosen tool for videocalls, the need to foster older adults' capabilities in using such tools and how important verbal instructions and their context were during the sessions.

During our sessions we included cognitive assessment using the Montreal Cognitive Assessment (MoCA) [24] which has been previously applied remotely with satisfactory results [25–27]. All studies had similar procedures: participants were given, mailed or emailed the required materials and interacted with a researcher via teleconference. After performing the visual exercises, participants were asked to hold the paper sheet up to the camera. Reported complications included minor technological difficulties [25–27], lack of adequate lighting [25, 26], participants' symptoms (tremors) [25] that interfered with their ability to show the results to the camera, maintaining eye contact [26] and difficulty in assessing how much help the participants were receiving from their caregiver [27]. Since all studies recruited participants with different conditions (movement disorders [25], Dementia [26], Parkinson [27]), the convenience of this method is highlighted since it does not require traveling, unburdening both patients and their caregivers. The participation of caregivers during the sessions is also seen as crucial to aid participants with the technological setup and provide them with the required materials [26].

3 Dataset

3.1 Context of the Study and Setup

Participants for the longitudinal study were recruited with the help of local caregiving organisations, who would also appoint one caregiver (henceforth called gatekeeper) to help researchers in doing the setup for the remote sessions. The sessions took place either at participants' homes or at institutions. At times, the gatekeeper was present throughout the session and, at times, absent. All sessions were moderated by the same researcher (moderator).

The longitudinal study protocol included a baseline assessment and periodic evaluations conducted every 3 months. The assessments have a neuropsychological and a user experience component. Cognitive performance was assessed by the Montreal Cognitive Assessment (MoCA) [24]. The WAIS-R version of the Corsi block-tapping test [28] was used to evaluate visuo-spatial memory. As for Psychological Well-being and loneliness, depressive symptoms were assessed using the Geriatric Depression Scale 15 [29] and loneliness was measured by Short-Form UCLA Loneliness Scale (ULS-6) [30]. Quality of Life was assessed by a combination of a subjective well-being measure—Life Satisfaction Scale [31], and a health-related quality of life instrument—EQ-5D-5L [32]. Regarding technology acceptance, we developed a model based on the Unified Theory of Acceptance and Use of Technology

Fig. 1 Setup on the participant side

by Venkatesh et al. [33], integrating gerontology-specific dimensions, such as technological self-efficacy and technological anxiety. This was complemented with a bespoke questionnaire to assess ICT experience, in terms of frequency and type of use. Lastly, a sociodemographic questionnaire was administered, with additional questions related to health, daily habits, and lifestyle.

Digital versions of the neuropsychological instruments were considered, but ultimately rejected due to incompatibility with our equipment's operating system, not being validated in the current population/language, and/or being too complex to implement remotely. MoCA was adapted to suit possible constraints in the remote assessment, specifically the visual exercises. A separate paper sheet with the Naming Task (naming three animals drawn on the sheet), an alternate version of trail-making B test, and both drawing tasks (drawing a clock and drawing a cube) was sent previously to the institution, to be placed next to participants during the session (Fig. 1). Participants were encouraged to show the sheet to the researcher after each drawing, and the physical sheets were later retrieved for evaluation. The Corsi block-tapping test was adapted into a hybrid (digital and physical) format, to maximize fidelity with the original version. The remaining instruments were administered as usual.

Protocol administration was split into two (sometimes three) sessions, allowing a conversational approach with participants, thus increasing researcher-participant rapport, and minimizing fatigue for participants. Each session began with video and sound testing, followed by an informal talk to make participants at ease and to assess their alertness and motivation. The administration paused in the event of persistent technical issues, or when participants showed signs of fatigue/discomfort.

3.2 Dataset Description

For this paper, we created a dataset of video recordings from the remote sessions of baseline assessment, by selecting the segment of the session assessing Visuospatial/Executive and Naming cognitive domains with MoCA. This segment was selected because it contained interaction dynamics which are used in user research and co-design sessions (spontaneous conversation, instructions giving, interactions with objects, and drawing) and could, therefore, be useful to render knowledge for

Fig. 2 Mosaic of screenshots from database videos

design researchers. It should be noted however that no analysis of the instrument or their applicability in a remote context was performed.

The dataset (Fig. 2) is composed of sessions with 40 community-dwelling and institutionalised older adults (Age = 83.7, SD = 8.2). The average duration of the videos is 10m10s (Max: 26m36s, Min: 1m11s). Thirty-five recordings were made at an institution and five in participants' homes. Twenty-seven recordings have the participation of a gatekeeper. In seven recordings, another researcher is also present in the call, although she did not intervene.

4 Procedures

The analysis of the videos was made by the three authors individually using mainly a deductive approach over a shared matrix of barriers and strategies. The authors registered their codes on the matrix and freely added codes to barrier types and strategies, when relevant, supported by quotes from the videos. The authors then engaged in periodical discussions about their data interpretations as the analysis was ongoing to ascertain whether there was consensus. Also registered, in this case using an inductive approach, were aspects which authors found noteworthy—these were not registered on the matrix, but on a separate, shared, note sheet.

Once all videos were analysed by all authors and the matrix filled in, we began a second phase of analysis to identify categories, which grouped codes. The identification of categories was made via two methods by two of the authors separately: using an affinity diagram and using the constructs of conversation analysis (CA). In so doing, the authors continued engaging in periodical discussions about their analyses.

The affinity diagram allows to group codes semantically using an inductive approach—where a set of codes is brought together with significant resemblance and characteristics that separate them from other sets of codes, a category is formed.

Conversation analysis can be understood as the study of interaction through talk, delves into a conceptual analysis of structures, dynamics, and organization of dialogue between two or more individuals [34]. Although it has been extensively researched in face-to-face settings, remote videoconference dynamics bring new communication challenges related to technology [35], and CA might complement design research methods by focusing on sociolinguistic analysis and thus enabling the understanding of the users' needs and feedback [36]. The exchange between the researcher-participant-gatekeeper was thus characterized in terms of three dimensions: turn-taking [37], sequence organization [38, 39], and repair organization [40].

Turn-Taking implies a structured order of exchange between two or more people in a conversation, one at a time and organized in turns, which are then composed by one or more turn construction units (TCUs) which are understood as cues (produced via grammar, prosody, but also via visual or action cues) by both participants and help the other person identify and predict the end of a speaker's intervention, thus maintaining the flow of conversation. When a turn ends, naming of the next speaker, or turn allocation, can occur via self-selection, other-selection, or not occur at all, in which the current speaker continues. Depending on where it is inserted, silence might also organically inform the dynamic of turn-taking and be indicative of issues with communication [41]. Videoconference turn-taking challenges can be perceived as procedural problems in the context of turn-taking even if they stem from technological issues such as latency [42].

Sequence organization revolves around the idea that dialogue occurs in a successive exchange of turns which are dynamically linked [38]. Those dynamics can take familiar forms, such as greeting-greeting, question–answer, request-accept/refusal, etc., but also more generic forms that fulfil specific co-understandings of the circumstances and type of conversation behind held. Through the understanding of adjacency pairs (AP), or a sequence of two turns (one by each speaker) that directly related to one another, we can infer the purpose or a certain message or speaker, while assessing subsequent APs. The impact of technology related issues, such as delay caused by latency, can turn a delayed preferred response (a sort of "positive/acceptance" expected response to the stated message) into a interpreted dispreferred response (a response that isn't necessarily negative or of refusal, but nonetheless does not match expectations derived from the previous stated message), simply because of expectations of timing [35].

Repair organization can be understood as an organized action to correct for issues that might arise in communication, such as a misunderstanding, issues with hearing or speaking (either from the speaker and/or the receiver) or for any other reason that results in the intended message not being passed [43]. We can further divide repair into two distinct phases [44]: repair initiation, in which the communicational issue is signalled, and repair proper, in which the issue is then corrected by either the speaker (in which case we would consider it to be a "self-repair") or any other element of the conversation (a "other-repair"). This sequence of both repair initiation and repair proper can be structured into some or all these elements: the trouble source (part of conversation that pertains to the repair), the repair initiator (the person who

addresses the trouble sources), the repair (in which the correction/change over the trouble source is made) and the repair confirmation (signalling the success of the repair). The organization of these elements may give rise to different types of repairs, based on the element that is responsible for each of them, the type of trouble source, or even awareness of it [40].

5 Findings

5.1 General Barriers and Strategies

Barriers

We identified general barriers grouped under Technology, Context and Person. ***Technology*** barriers relate to audio (low voice volume, cuts in the audio, and audio delays), image (highly pixelated (Fig. 2 E) or freezing) and the Internet connection, which may fail altogether. Unexpectedly, they did not seem to impact communication greatly, as they frequently did not impel the parts to act to solve them. There was a mismatch between researchers' anticipated barriers and what effectively was the case, which is similar to the experience reported by Cerna et al. [5].

There are barriers related to the participant's ***Context***, which include the physical environment and the actions of the gatekeeper. Not only is it important to have a physical environment where the setup for a remote session can be done, but also one where participants will be able to interact with pencil and paper and show their exercises to the moderator. We found that participants might have poor conditions to draw, might have low illuminance levels or need assistance with equipment. Whilst the gatekeeper is often a valuable assistance, they can unintendedly create barriers as well: in the videos, gatekeepers sometimes interrupted the interaction between moderator and participant, overhelped participants in exercises or had difficulties in placing the camera (obstructing view (e.g., Fig. 2 A, B, V) or sound).

Person-related barriers often refer to the participant, but also to codes identified in relation to the moderator. Concerning participants, barriers are mostly connected to functioning (in the sense of the ICF [45])—the person shows auditory/visual difficulties, deficits in attention or difficulties in understanding instructions. However, we have also found barriers regarding participants' mindset, which both moderator and gatekeeper seem to be aware of. As participants are being asked to perform an activity, they often verbalise how they think they are not up to the challenge and comment negatively on their performance after executing the activity. The moderator may find it difficult to have the necessary situational awareness that helps steer in-person sessions. In one case, the gatekeeper tells the participant she will be doing a last thing before joining her colleagues for a snack. In prior analysis of strategies in user research with older adults, we found this situational awareness to be relevant for moderators [13].

Table 1 General strategies: theme, sub-themes, and categories

Participant performance	
Understanding	Executing
Clarification	Tasks on exercise
Context	Physical conditions

Strategies

The participant, the gatekeeper and the moderator engage in strategies to overcome the barriers. All strategies fall under the theme of ***Performance***, here defined in relation to the research participants as the process of performing the activities planned in the protocol. This theme includes two sub-themes: ***Understanding*** and ***Executing*** (Table 1). The first refers to aspects of communication and the second to aspects of executing instructions of the MoCA. We will go into more detail for each sub-theme.

Understanding

As we will see in the next section devoted to communication aspects, all parties in the videos engaged in strategies to improve mutual understanding through ***Clarification***. This was shown by providing physical support, using gestures in addition to spoken words (Fig. 2 D, J, P), repeating instructions, paraphrasing or in breaking information. In one instance, the gatekeeper explained to the moderator that the participant was using a word in a foreign language to name one of the animals. This is one of the instances where we notice the role of the gatekeeper in preventing misunderstandings. There were often situations in which the parties need to request confirmation about elements on the sheet to guarantee that there is no misunderstanding, either by identifying where they are in the sheet or their characteristics, e.g., moderator asking about the circle in the clock drawing: 'Did you make it large, like this?' [gestures a large circle in the air] (P37). Although these kinds of clarifications probably made exercises longer than they would have been in person, we also note that they do not seem to have had an impact on how the exercise was performed.

There were also times when the intervening parties required more ***Context*** about the situation at hand. Here, the role of the gatekeeper is noticeable, when they provide the moderator with context which is critical to his understanding of the situation. The gatekeeper informing that the participant has poor eyesight is an example of conveying important information that aids understanding. When participants are not sure about their performance, they might also verbalise it. And, at times, providing context has the double function of supporting participants' self-confidence, e.g.:

Moderator: 'We're making you sweat today'
Gatekeeper: 'She likes it. She likes challenges' (P23)

Executing

The strategies under this theme serve to support the participant in having the conditions necessary to perform the exercises which will help make a neuropsychological

assessment. Verbalisations, from gatekeeper and moderator, giving encouragement to participants are very salient and mostly help address signs of poor self-confidence. They arise in relation to specific ***Tasks on the exercise***. The gatekeeper uses their physical presence on site to direct participants' attention to parts of the sheet or to course correct participants. Since the sheet is frequently barred from the moderator's view, this strategy is supportive of the user research process. Gatekeepers remind participants that there are parts of the exercise missing, they erase participants' drawings when they wish to redraw, and they redirect participants' attention. The physical presence of the gatekeeper allows them to improve ***Physical conditions*** for participants. Gatekeepers often improvise solutions, such as using a smartphone flashlight to illuminate the participant's sheet (Fig. 2 E), placing a harder surface underneath the paper sheet to help the participant draw (Fig. 2 G), leaving the room momentarily to fetch participant's eyeglasses (P27), making adjustments to the camera while the exercises are ongoing or picking up paper sheet and showing it to the camera (Fig. 2 F, L). In two occasions where the gatekeeper was absent from the room, the moderator was forced to phone call them to aid—this happened once because the participant needed help to place the pencil on his hand orthosis and another time because the gatekeeper had forgotten to leave a MoCA sheet with the participant. When the gatekeeper came in, she said 'Oh, the camel sheet'. Camel was the first animal named by the participant in the animal naming exercise (P47). In some situations, the presence of the gatekeeper and the strategies adopted to support execution of the exercises can ironically become a barrier and compromise the session goal.

Having looked at general aspects of the remote user research sessions, we will now look in more detail about communication issues, some of which were already alluded to in this first overall analysis, e.g., verbalisations of encouragement, verbal prompts for exercise completion or strategies to deal with technology malfunctioning.

5.2   Communication Aspects

Turn-Taking

Turn Taking was characterized by the means of turn allocation, the nature of TCUs, and the use of silence. Gatekeepers' interventions occurred by two means: self-selection and other-selection—in which the participant would allocate the turn to the gatekeeper. Both turn-allocation types resulted mostly in a positive impact for the conversation, denoting the support role of the gatekeeper, as it stemmed from either repeating (or being asked to repeat) instructions to the participant in cases of mishearing, misunderstanding, or, specific to self-selection were not performing the exercise as asked (e.g., drawing in a different spot of the page). Self-selection also occurred to signal audio/latency issues and to encourage and compliment the participant's performance.

In some cases, self-selection had a negative impact on the conversation, acting as a disruptor of dialogue between the research and the participant, or by overhelping

during the execution of an exercise. In those cases, the researcher only self-selected after the exchange between the gatekeeper concludes and the task is resumed, in which case the participant is other-selected via use of their name.

Silence in turn-taking was used primarily in three moments: a pause was made whenever naming at the start of a turn occurred, to aid with attention-grabbing (particularly in cases where the participant would other-select the gatekeeper and them in the conversation), giving time for the participant to focus on the research and the assessment could continue. Gaps after a participant's turn were purposefully extended by the researcher to account to audio delays/latency, and to minimize the risk of turn overlapping giving the already mentioned factors. Silence was also observed due the nature of the exercises and the context of remote assessment, since the researcher could not see the sheet in which the participant was drawing, and thus would either extend the silence until the participant's self-selected to communicate they had finished the exercise or self-select and ask for an update.

Technology did not seem to majorly affect turn-taking, and other-selection via pragmatic methods and prosodic determined that turn overlap between researcher and participant was minimal. When it did occur, the researcher would resort to either stop talking and wait for the participant to finish, or briefly communicate non-verbally.

Sequence Organization

Sequence organization was classified in terms of expansion types and related adjacency pairs. Pre-expansions were regularly observed in form of summon-acknowledgement APs and intentionally used to grab participants' attention as they were executing a task (e.g., drawing), had engaged in conversation with the gatekeeper, or were otherwise distracted. This ensured that, given the circumstances of remote communication, the main message would not be initiated until the researcher was sure that the participant was alert and focused on him thus minimizing the number of repetitions throughout the conversation. This measure would also constitute a proactive way of dealing with eventual audio delays and latency issues.

Pre-expansions in the form of request-accept/refusal were used when introducing tasks (e.g., *d*rawing) and were followed with external encouragement in case of a dispreferred second (a scenario where the participant would give a negative response).

> When asked to perform a task:
> Participant: 'Oh, I don't know how to do that.'
> Moderator: 'I'll help you.' (P38)

Pre-invitations related to the context of the visual sheet, which the researcher could not see on camera, leading to feedback regarding performance. Expansions were observed in instances of repair initiation (whenever the repair initiator was the participant) and post-expansions were observed after the participant had just been tasked with an exercise, in the form of a turn with external encouragement. Question–Answer post-expansions were also used to guarantee that the participant understood the assignment.

Repair Organization

Repairs were related to issues of mishearing and understanding, the latter frequently attributing the trouble source to the exercises' instructions.

> Moderator: 'Let's place a clock pointer for the hours and another one for the minutes'
>
> Participant: 'Like a line?'
>
> Moderator: 'A line, exactly.' (P43)

Self-initiation of repair also accounted for situations in which the researcher clarified instructions, particularly when related to visual elements on the MoCA sheet. In one example, the moderator asks if the participant can see the cube, which causes the participant to look at the Corsi cubes over the table. The moderator corrects: 'the cube on the sheet' (P37).

Technical issues (audio quality dropping, latency, or background noise) were identified in many occurrences in which mishearing occurred, with the participant acting as the primary repair initiator and repair confirmation element, with the gatekeeper acting less as a repair initiator and more often as repair confirmation element.

> Image freezes for some seconds, Moderator waits for it to come back.
>
> Moderator: 'Can you hear me now?'
>
> Participant: 'Not very well'
>
> Moderator: 'It will improve in a second' (P36)

6 Discussion

The goal of our study was to identify communication barriers and strategies when conducting remote sessions with older adults to inform researchers planning similar design research sessions.

Our sessions were conducted while participants were in an environment that was familiar to them: their nursing home, their day care centre or even their own home. As expected, this context allowed them to feel more comfortable and at ease, providing the best environment for conversation flow and avoiding some of the discomfort and anxiety caused by an unfamiliar setting. Since participants were not required to travel, this also allowed us to split each session into shorter ones, avoiding burdening the participant, as recommended in literature [12]. From the researcher point-of-view, this meant several sessions per day which, albeit tiring, was also time saving allowing a high number of sessions to be conducted in a shorter time frame. Even though equipment and its setup were previously tested, when the same setup was replicated in each setting, variables such as room acoustics, available furniture, light conditions or background noise impacted how sessions were conducted, similarly to what previous studies reported [25, 26]. Solutions were diverse, and while some relating to the general environment were more consistent (e.g., connecting speakers to the tablet) others were contextual and dealt with as required (e.g., directly lighting the sheet with a flashlight for a participant). This showed us that while remote sessions

widen the possibilities, not all places are appropriate and certain conditions will need to be addressed, previously or even during sessions.

The involvement of caregivers proved to be crucial to mitigate unfavourable physical conditions in participants' settings showing that in remote sessions their role clearly extends beyond being an important source of information about participants [15], as also mentioned by Lindauer et al. [26]. Nevertheless, at times challenges can also be caused by caregivers' or participants' specific actions. During sessions, we observed caregivers misplacing the equipment or holding it in a way that muffled the sound.

Participants' actions such as getting too close to the camera or soft speaking were also observed obstacles that can denote lack of experience in remote interactions. Nevertheless, despite this inexperience, our observations do not suggest that participants felt additional anxiety specifically caused by it nor by the assessment that was being performed in the analysed videos. There were, however, several verbal expressions of low self-confidence regarding their performance, particularly in drawing tasks. Both the researcher and caregivers had an important role in these situations, reassuring the participant, adopting a non-judgemental posture and maintaining a casual conversational approach. Without physical presence, all parties can struggle to interpret non-verbal cues, which, as stated in [10] can be used to complement and add significance to verbal interactions. Consequently, verbal instructions can sometimes lack context and be insufficient for their recipient, as observed by Cerna et al. [5]. Likewise, our observations showed that the researcher conducting the session provided additional information when instructing participants (e.g., the exact position in the sheet, in reference to other elements) or was supported by the onsite caregiver who intuitively complemented information that would otherwise be clearer if non-verbal cues were easily perceived (e.g., indicate the exact position in the sheet while looking at it). This showed us that while analysing remote sessions, it is important to focus on conversational aspects as they gain a new dimension in this setting.

6.1 Minimizing the Impact

Conversational dynamics are constructed locally, as participants co-actively identify and recognize signs, actions, and structures of speech that can be understood and used congruently during a conversation within specific circumstances, and thus minimize the impact of external disruptions to the communication. In our study, letting the participant know before-hand that the communication might momentarily fail, or what to do in case of audio delay, was an effective way to manage expectations when such issues occurred and allowed for an implicit structuring of communication during those moments (in which one or both participants briefly "wait out" for the re-establishment of proper audio signal). And although these issues might originally stem from technology, it's important to understand how both researcher and participant might appropriate them in a communicational matter, such as longer spacing between turns.

At the same time, analysis of sequence organization showed us that, just like in presential sessions, remote conversation in this context can be broken down into segments of exchange that can serve multiple purposes—such as attention-grabbing, preparation for the message, navigational aids (in case of the drawing exercises), or simply as means of inserting informal talk, resulting in a more relaxed and pleasant experience for the participant and help reduce the formal tone commonly associated with assessment.

Lastly, understanding the importance of self-initiated repairs by the researcher, particularly in moments where instructing the participant in an exercise, serve added importance to proactively avoid scenarios of misunderstanding or mishearing of the instructions that might originate and not be recognized, and thus preclude repair. Since the researcher in this setup is not able to see the visual sheet unless shown by either the participant or the researcher, making sure that the instructions are understood is paramount.

6.2   Assessing the Impact

It is not always possible to identify the origin of miscommunication or understand its cause. During the identification of barriers and obstacles to communication, it was not always clear whether such trouble sources stemmed from a technology, or due to participant-related factors, such as auditory difficulties, comprehension difficulties, lack of literacy, or difficulties related to the task. In a set of task-related interaction of this nature, mishearing or misunderstanding of the message can lead to repair proper, either self or other-initiated, and prevent loss of value during conversation and guarantee adequate means to perform, but only if repair initiation, or the awareness of the trouble source, both in nature and content, is identified by one of the conversational agents. This is where active questioning by the researcher can be crucial to identify barriers to communication that might otherwise be ignored. Understanding of lapses, or even dispreferred responses, might indicate the need for clarification, and the employment of specific strategies that can be employed to immediately address the issue, such in issues of perceived lack of competence, confidence, or understanding.

The gatekeeper here gains a particularly important role, as a facilitator or both repair: firstly, acting as a privileged source of repair initiation as their physical presence can facilitate the identification of nature the trouble source, and secondly, because in case of such trouble source be of technological nature, execute both repair proper and repair confirmation.

7   Conclusion

Our analysis indicates that the identified barriers do not invalidate remote sessions from being applied for design research, and the observed strategies can be employed

to minimize possible constraints of this method. It should be noted as a limitation of our findings that the analysed videos only included a subset of the time spent in each session, excluding other dynamics such as session progression or initial rapport. Nevertheless, our discussion takes into consideration self-reflections from researchers involved in the sessions. While performing the analysis of the videos it came to our attention that recordings do not entirely reflect the reality of the session: the video includes both points of view (participant and researcher) equally divided on the screen but during the session the researcher had a full screen view of the participant. This prevented us from completely understand what the researcher could see, for instance, when the participant or caregiver lifted the exercise sheet to the camera. At the same time, regarding the nature of miscommunication occurring during a session, it was not always possible to determine if such was related to issue regarding technological aspects or related to the participant itself. Lastly, it's important to understand that the time-window analysed specifically pertained a scenario of psychological assessment which might differ a regular conversation, and thus, impose different rules and structures in turn-taking, transitions, and sequence organizations between the researcher and the participant.

During our sessions, we contacted with different seniors and caregivers, in different settings and with varied profiles in terms of age, education, location (urban vs suburban) or social-economic status. Albeit not the focus of our investigation, we observed that these variables seem to influence their relationship dynamics and how they perceived and interacted with each other and with the researcher and would be an interesting topic for future research. Future studies should also address conversation analysis in remote settings with older adults, integrating new measures to analyse technological difficulties, such as real-time latency metrics, and explore assessment-specific structures and dynamics of conversational organization.

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Digital Security Narratives in the Time of COVID-19: A Case for Kindness

Lizzie Coles-Kemp and Peter A. Hall

Abstract The COVID-19 pandemic has shined a light on the digital divide and its implications in a digital-first society. In the UK, where our research is focused, parts of society still lack the infrastructure and/or basic skills needed to access essential online services like health, welfare, food, housing and education. During the pandemic, these services became digital by necessity, forcing many people to seek help through informal networks such as community hubs. Based on our focus groups and interviews with voluntary and third sector organisations in the UK, we make a case in this chapter for a kinder, more holistic approach to the accessibility of essential online services, based on the hypothesis that such an approach creates the types of spaces in which the benefits of such services can be more safely realised.

Keywords Care · Digital divide · Digital inclusion · Kindness · Privacy · Welfare · Service design · Holistic and usable security

1 Introduction

As essential services moved online by necessity during the COVID-19 pandemic, access to education, health, welfare, food and housing services became dependent on access to the internet. In the UK, where 1.5 million households have no internet access, and an estimated 10 million people lack the basic foundational skills needed to access online services, one common reason cited for low digital engagement is concern about privacy and security [1]. In this chapter we argue that the design of online systems, the security logics that shape their access and the socio-material assemblages around them have the effect—intended or not—of excluding populations.

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Rather than frame this problem with a discussion of assistive technologies and inclusive design, we start this chapter with a case study drawn from primary research, which we then consider in terms of alternative security and service design narratives. This approach, based on the COVID-19 support experiences of a community group in North East England, is driven by a suspicion that conventional framings of security and accessibility privilege solutions based on incremental technological improvements rather than a more holistic response. We argue that new driving narratives are needed that account for the relational ways in which people in their day-to-day lives conceive of digital security, to supplement the dominant narratives of a *negative* security where a "referent object" (property, data, the state) is presented as needing protection, usually through technological means. An alternative narrative of a *positive, enabling* image of security, drawn from the field of International Relations, is not premised on protecting a referent object but on "making something possible"; in this position, security has "the property of a relationship" (McSweeney 1999, cited in [2], p. 778). We identify analogous approaches in sociology and urbanism, where the security of a city is reimagined less in terms of protective measures and more in terms of invisible or unnoticed acts of "kindness"—such as repair and care—that are fundamental to the maintenance of everyday urban life [3]. Our case study is taken from a focus group and a follow-up interview with Pallion Action Group in the North-East of England, one of many community organizations that have stepped up during the pandemic to provide support to those on the wrong side of the digital divide.

2 Framing: A Case Study

Our work is framed in the COVID-19 pandemic experiences of voluntary and third sector organisations up and down the UK who found themselves as the first and last line of support for vulnerable and underserved individuals and groups trying to adjust to day-to-day existence shaped by physical isolation, extreme uncertainty and digital-only access to everyday support. As part of a study of assisted digital access funded by the UK's Research Institute for Sociotechnical Cyber Security,[1] we invited voluntary and third sector organisations to take part in a series of focus groups held over Zoom to discuss how such groups were supporting the digital access needs of their community. Inspired by these focus groups, we took the experiences of Pallion Action Group, one of the community groups that took part in this study and followed up by interviewing the manager of that group (Karen Noble) to form a picture of how they have supported their community members with digital assistance from March 2020 to present day. Direct quotes from the focus group and follow-up interview are presented in this section. We set out these experiences to frame our subsequent argument for a kinder, more humanistic, and relational form of digital security.

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[1] https://www.riscs.org.uk/digital-responsibility/.

Pallion Action Group provides monetary, debt and welfare advice and support to vulnerable groups. Pallion is one of the most deprived areas of Sunderland and the community organisation has been providing support in the areas of welfare access, household finance and employment training since its start. As part of this programme of work, it has been providing digital skills training and support for digital access. Pallion is a suburb and electoral ward in West Sunderland in North East England. Since its founding in 2005 as a residents' group, Pallion Action Group has changed its focus from supporting primarily youth services to becoming a community hub, initiating activities to build support networks in the Pallion area. During the pandemic, Pallion Action Group's assistance with services such as providing activity packs for families, collecting prescriptions and shopping for self-isolating and housebound residents, and supporting people with accessing online services has increased, prompting the local council to recognise its work and that of other community hubs with further funding.

Overall, the group has reported a significant increase in the number of people accessing its services—3000 new signees (individuals and households) since the start of the pandemic—as well as a broadening in the range of people seeking help during the pandemic, and in the kinds of services provided. Whereas prior to the first lockdown and shift to digital-only services, the typical visitor to Pallion Action Group was an older person needing assistance with online services who was "*scared to touch a button or …who just didn't do digital things,*" [4] the pandemic prompted younger people to seek help: "*kids who were supposed to be [school]working from home, who didn't have the digital equipment or they didn't have Internet access. Then we had parents who didn't have the digital skills to help the kids get online…so I think our first issue was about trying to get people to understand what digital equipment was and what was best for them. We had to go back to basics for a lot of people.*" [4].

The pandemic saw a shift from digital by default to digital by necessity for many essential and statutory everyday services in welfare, health, finance, food and education. Whereas pre-pandemic, those needing to access the services essential to providing household income (such as housing support and access to benefits) could make claims in person, digital by necessity meant that community hubs such as Pallion Action Group were called upon to devise a way to support claimants with no internet access, such as filling forms over the phone: this sometimes meant an advisor going through the form fields with the claimant, typing their responses, printing out the form with an indication of where it needed to be signed, and then posting it to the claimant or arranging for it to be picked up. Those seeking help with this kind of support, for example in making Universal Credit claims (monthly Government payments to help people with living costs), can have a high level of trust with the assisting organization, a trust built up over time based on reputation and familiarity of known individuals in the hub: "*If you didn't have your computer access, you couldn't warrant Universal Credit claims and that puts you at risk of not being able to get paid. So there was a lot of confusion around that. And the amount of people who followed up and said, can I give you my login details?*" [4].

Such assistance is not merely helping the individual with managing the bureaucracy of the service but also offering emotional support and empathetic support. This is because the pandemic created a stressful environment in which household resources were severely constrained, job security was threatened, and household dynamics were severely disrupted. For the households that Pallion Action Group support, this took an emotional and mental health toll as well as placing a financial burden. The complexities of accessing online services and the challenges of coping with wholesale change to the ways that services essential to wellbeing were provided were experienced against this backdrop of heightened pressures.

At the same time, the pandemic has put a severe strain on the ways in which an organisation can offer assistance for each individual and the wider community because much of the support now has to be provided over the telephone or via the web. Pallion Action Group therefore had to work out how deliver digital skills and support as part of a wider set of services intended to work with the *whole person*, not just their administrative needs. In the original focus group Noble stated: "*So, we got funding to get tablets for people; and on there we have put quizzes, surveys about the impact of COVID, and mindfulness and meditation activities, photography competition with prizes; also we've put guides about how to get on Zoom and other things.*"

This *whole person* approach is one that addresses the human security needs of the individual, placing support for digital access in the wider context of the safety and security of the individual and their families. In the focus group, the following story was related, regarding meeting an older person struggling with shopping during the pandemic: "I *had a gut feeling about [this] one lady who sounded down; all of the usual things have been taken away by COVID, she had no social circle left, she was just left to vegetate; and the agencies knew about this, but nothing was done… Age Concern [were] charging £15 per hour to go shopping; which is why we got involved*." This was part of a wider pattern, it was said, of increased isolation and desperation which the organisation was attempting to combat through initiatives such as the one described above: "*A common story is older and more vulnerable very isolated people, no contact, no devices, this really sticks with me; in the first instance we are arranging to drop off a prescription; [they say] "you're the first person I've spoken to in ages"; she wanted to just go next-door and mix with people, and didn't care about the consequences—amounted to suicidal feelings; during the pandemic we've noticed a lot more suicidal people, over 70 especially.*" Securing the whole person is underscored by the way that Pallion Action Group places as much importance on mindfulness and yoga sessions as it does on e-safety training and skills development. From Pallion Action Group's point of view, both contribute to the safety and security of the individual.

3   Security Narratives and the Digital Divide

The Pallion case challenges how we conceptualise digital security and what it means for an individual to be digitally secure. From the perspective of Pallion Action Group, digital security is a combination of caring for the wellbeing of people and ensuring that data and access is technically secured. As the different dimensions of the digital divide reflect, access to technology is contingent on physical access to security technology and the availability of the underpinning technical and data infrastructure. Regardless of whether an individual independently accesses a digital service or requires help, the technological controls used to regulate access need to be usable, accessible and inclusive if the digital divide is to be bridged. Such controls typically include authentication processes that deploy a username and password, digital identifiers that link data to a specific individual, and permissions to access particular fields in an online form. However, as the example shows, for many marginalised and underserved groups it is not enough to develop an individual's practical skills in securely accessing digital services and resources. Pallion Action Group's pandemic experiences show how alongside the technical security of access control to secure an individual, the emotional wellbeing of an individual must also be attended to. Emotional wellbeing is primarily achieved through acts of care that take place through human relationships creating a relational form of security. Contrary to popular misconceptions that "acts of care" suggests warm feelings, "do-gooder" behaviour, and subjective, unquantifiable aspects of security, we venture that it can be reconceived and recognised as an essential aspect of system maintenance that should be woven into any framework and policy that sets out principles of digital security. This argument builds on nascent scholarship in this area [5, 6].

The COVID-19 pandemic foregrounded digital inequalities and the ways in which those without access to digital devices and services are disbenefited in the most fundamental of ways when a society shifts from being digital by default to digital by necessity. Digital exclusion is a multifaceted concept and is typically considered from three perspectives [7]:

- Physical access to digital devices.
- Skills to navigate the digital world.
- Inequalities of access.

The move to digital by necessity emphasised the importance of technology and its security being accessible for all. During the pandemic, all age groups have seen an increase in the need to access essential services online [8], but there are still parts of society that have remained digitally excluded, resulting in an increased risk of COVID-19 infection and an increase in social and economic isolation. Accessibility issues play a role in this picture of digital exclusion: economic cost, lack of digital skills and fear of online harms are all cited as reasons for digital exclusion during the COVID-19 lockdowns [1, 9]. Moreover, the availability of digital services has also been an issue and regional variations in quality of Internet access have been highlighted during the lockdowns [9]. COVID-19 has also revealed that trust in

technology and institutions plays an important part in questions of accessibility. Within some sectors of society, there has been a marked degradation of trust between communities and the state during the pandemic [10]. This, in turn, can result in digital inclusion itself being regarded as a potential harm.

Traditional security analysis focuses on state-centered concerns [11] as the site of where security is done. Security logics, or the reasoning that underpins security strategies, can broadly be divided in to positive and negative forms of security [12] where positive forms of security enable people to live free from fear of attack and negative forms of security protect people from threat and harms [2]. Doty [12] argues that the dominant security logic is a negative security logic that is typically one of exclusion which depends upon an understanding of self and other that is framed by a notion of territory. Doty identifies three main security logics: national security logic, societal security logic and human security logic. *National security logic* is a traditional security logic focused on the protection of the state against existential threats. It is negative in the sense that security is perceived as protection against external threats to the national/state territory. *Societal security logic* foregrounds identity politics and society as a site of security but recognises the dependency of societal security on the security of the state. *Human security logic* is a human and individual-centred conceptualisation of security. It is a positive security logic where security is perceived as a desired good which enables access to a good life. It is a logic of inclusion, which transcends state boundaries and supports pluralistic conceptions of identity.

Much of the focus in the traditional canon of security thinking is on the doing of security [13] and the doing of security is often performed through security technologies ranging from military weapons to passwords and file permissions [14]. The dominant narrative and messages around technological security predominantly reflect negative forms of security [14] where the focus of such technologies is to protect the technology and the data from adversaries performing attacks via technical means. However, the picture of digital access that Pallion Action Group provides us shows how safe and secure access to digital services is not simply about using tools and technologies for protection. Supporting secure access to essential digital services requires an attentiveness to the tensions, emotions and cultural understandings that are woven around such access. This is very much a human security logic where security is a desirable way of being that should be available.

Security scholar Paul Roe has argued that responses to protecting entities such as a state or society need to be a combination of positive and negative security for individuals and societies to live securely [2]. Whilst the dominant narrative around security technologies is predominantly one of negative security, digital security technologies are particularly malleable and are often able to support both positive and negative security positions. This malleability can be seen in the way that such technologies can be appropriated and re-configured to respond to different threat models [15]. For example, a technology that monitors location might be used as a stalking device [16–18] or as a physical security protection mechanism [19]. Privacy and security technologies can also be configured and practised to protect against adversaries that were not envisaged at the design stage. For example, [20] describe how throwaway

email addresses and anonymous apps are used to provide protection to abused women from family members. It could be argued that such re-configuration and diverging appropriations of security technologies are a form of "design in use" which describes the re-assembly and re-configuration of technology once it is deployed [21]. It could therefore be argued that it is in the assembly and re-assembly of security technologies that the positive or negative security position of the technology is often enacted. Pallion Action Group's approach to community support with its focus on human security reflects this blended positive and negative security position. The support that Pallion Action Group provides in assisting an individual's digital access takes the following forms:

- adapting support to enable the individual to realise the benefits of digital service access (positive security),
- providing a listening ear, to focus on a person's overall wellbeing and provide empathetic support (positive security) and
- supporting the digital set-up of protection controls to protect against digital threats (negative security).

As such, Pallion Action Group's approach requires confronting the intersections between technology and inequality, and is built on an understanding of security roles and responsibilities that could be interpreted as a form of social contract [22].

4 Limits of Common HCI and Service Design Approaches

The blended logics of positive security provide a perplexing problem for the design of online services, from the development of their user interfaces to their security design. Typically, a design approach might map out a typical user journey, identifying points of friction in, for example, a user's efforts to claim housing benefits, the contributing factors to those points of friction, and where improvements to a service design, user interface or security design might be introduced to address the problems identified. Yet, conventional design approaches struggle to deal with the multiple disciplinary perspectives at play in these situations (e.g. see Vines et al. on the "ageing" user [23]). Novel assistive technologies, for example, can support specific users facing specific challenges when they have been identified, but not when the users in need have not been identified or have not come forward seeking help. Sociologists (e.g. [24]) have used the phrase "care avoidance" to describe the issue of people in need of support who do not come forward, and "care paralysis", where service providers and professionals find reason not to get involved with "disagreeable" clients.

Another common method employed in design approaches is to construct personas—fictional characters based on target users of the service—and hypothetical scenarios that capture the design problems identified. Introduced by Alan Cooper in 1999, personas are considered a good way to represent real, relatable user needs, to measure the effectiveness of a design, to inform better design decisions and for multi-disciplinary teams to communicate with each other [25]. The limitations and pitfalls

of a personas-based approach, however, include their tendency to overlook people who do not conform to the picture of the "typical" user such as those with disabilities and other challenges. At the same time, if a persona is purposely constructed to represent a particular challenge, it can give designers a false sense of understanding their users. A more general limitation of the persona method is that it "creates an extra layer of interpretation between users and developers and thus can create a greater distance" [26]. While a person's inability to access online services might not be due to a limitation in resource or capability, the assumption of particular competencies or capabilities built into user interfaces and service design is clearly one of the most pressing design flaws in the current design of online services.

More fundamentally, personas tend toward an individualised conception of a problem space, whereas online services such as health, welfare, education are fundamentally relational. Cipolla and Manzini [27] have argued for a particular kind of service configuration that is relational. Drawing from philosopher Martin Buber's conception of a distinction between "I-Thou" encounters (between two holistic beings) and "I-It" encounters (between a person and an object or a representation of a person), they argue that relational services follow a circular interactional model that where benefits are reciprocally produced:

> Relational services are defined here as those deeply based on interpersonal interactions, particularly favouring "I-Thou" encounters. They are challenging the standard way of conceiving and offering services. [27, p. 3]

By way of example, Cipolla and Manzini contrast the standard school bus service with a "Walking Bus" relational service. The standard service is conceived as a mechanical operation, wherein the driver can perform his function on an anonymous basis, and can be substituted by another driver with the same technical skills, and where any interpersonal output (e.g. friendship with users) is not seen as an essential part of the operation. The relational service, designed to encourage children to walk to school with a group following predefined routes under supervision of adults (generally pensioners on a voluntary basis) is strongly based on the relational qualities produced between the participants—such that the participants cannot easily be replaced [27, p. 3].

In the Pallion examples encountered in our primary research, the trust engendered in the community by a community hub is not transactional, and does not seem to be replicable in I-it encounters between human and software; it is rather based on the relational qualities produced between the participants. The "care avoidance" instance above, for example, is specifically addressed by the broader relational quality of trust engendered by a community hub well-established in its geographical area, where a person in need of help is typically identified by a concerned neighbour. Pallion Action Group pro-actively encourages this kind of positive security with the use of the phrase "don't wait till you're in crisis" on its Facebook page. "*We know our community inside out and there's a lot of word of mouth and a lot of people have had help from here, so I usually get a people who either message me or send us an email or a Facebook message saying "so and so I'm really worried about them"*" [4].

It is clear that the positive security examples provided by our research present a relational rather than standard model of service design: while specific points of friction might be identified and addressed with improvements in the user experience such as verification-by-phone, or even theoretical innovations to authenticate trusted third parties (for example [28, 29]), the positive security framework facilitates a more holistic reconceptualization of what we mean by security.

5   A Case for Kindness: Understanding Needs in Context

Analogous approaches to positive security can be found in discourse on cities. The sociologists Hall and Smith [3] argue that the routine but often invisible ways in which people are maintaining the city–the "looking after, helping out, cleaning, fixing up" [3, p. 3]—might be reconceived as a "politics of urban kindness" (p. 5). Extending the concept of repair and maintenance to the care and welfare of people, Hall and Smith find analogous examples of the constant upkeep required to maintain the complex machinic order of the city in "minor acts of social repair" from marriage guidance to outreach services, youth mentoring and support groups: an "infrastructure of kindness" (p. 11). This position builds on the ideas of Nigel Thrift, who has argued that cities are responsive to catastrophe in part because they are constantly adding "new circuits of adaptability" [30, p. 202]. One manifestation of these circuits is the "hum of continuous repair and maintenance" from the noise of pneumatic drills to the knock on the door of a repairman to the emergency services cleaning up small but sustained disasters [30, p. 202]

To align the politics of urban kindness with positive security requires that we consider the support work of voluntary and third sector organisations as integral to the design of online services, not an aberration, or workaround. The response to COVID-19, as with a city's response to a natural disaster or other catastrophe, depended not just on digital infrastructures, but the "circuits of adaptability" of social support networks. This in turn requires that the design process also consider the integral role of "minor acts of social repair" and urban kindness in the so-called user journey typically modelled in the design process. To incorporate, for example, a "user's" phone call to a community hub that results in a completed form being mailed back to them for signing and posting suggests a broader, more holistic account of the user experience than a conventional account.

The post-war design of cities was considerably influenced by Jane Jacobs [31] book *The Death and Life of Great American Cities*, which argued in a chapter on safety and security that the public peace is not primarily kept by the police but by an "intricate, almost unconscious network of voluntary controls and standards" kept and enforced by the people who live and work on a street [31, p. 32]. Drawing from her own observations and city crime statistics, Jacobs posited that safe city neighbourhoods had three main qualities: (1) a clear demarcation between public and private, (2) "eyes upon the street," meaning not surveillance cameras or police patrols but the watchful eyes of its residents, business owners, regulars; and (3) streets

must be populated fairly continuously, both to increase the number of eyes on the street to give those street watchers something to look at. The street watchers, Jacobs argued, were not looking out for crimes to report, but were engaged in a form of observation that is there to protect the values of the community as decided by the community. "You can't make people watch streets they do not want to watch" (p. 36). "A lively street always has both its users and pure watchers" (p. 37). Jacobs helped to move city planning away from a separatist approach to city building, and helped bring about the mixed use, more pedestrian friendly spaces that began softening the neighbourhoods annexed by highways and high rises in the 1960s and 1970s.

In a similar way to the minor acts of social repair that keep a community in good order, Jacobs's "eyes on the street" enact a positive security that enacts a shared value system and even pre-empts breakage. The "word of mouth" scenario described above, whereby a visitor to the community hub confides that they are worried about a neighbour, prevents a potentially greater crisis and enacts a sense of *shared,* ontological security. Roe defines ontological security as "the maintenance of the day-to-day routines that provide us with a sense of who we are and how we relate to others" [2, p. 778]. This can extend to the ambient sounds that we often associate with a sense of bustling or shared spaces. Thrift's "hum of continuous repair and maintenance" in this sense supports an ontological security that is situated in the everyday routines of people. An example might be the elderly woman who keeps the television on low volume all day to imbue her home with a sense of ontological security.

The aim here is not to varnish, or Romanticise acts of social repair or urban kindness. The "values of a community" are, of course, negotiated by communities, and will include less-than-law-abiding values as well as frequent contraventions of those values, as in the numerous examples of pandemic-era scams that emerged in focus groups with Pallion Action Group. Values and a sense of order are precariously maintained, even with unwritten codes such as that which condones fraudulent Universal Credit claims but not stealing from one's grandfather, the proverbial "honour amongst thieves" [4]. Hall and Smith also note that keeping things and people well looked after is a political activity as much as it is practical, and this is not a simple politics when "repair" is imposed rather than reciprocal. Rather than present a Romanticised account of kindness as a form of positive security, we argue that narratives driving the design of online services need to take into account these essential but often invisible aspects of system maintenance.

In closing, it is illustrative to identify some of the characteristics of a more dominant narrative of digital security by looking at the current website for the UK Government's National Cyber Security Centre (NCSC), which presents guidelines and practical steps for individuals and families as part of its broader information section. In defining cyber security, the NCSC clarifies that its "core function" is to protect devices (smartphones, laptops, tablets and computers), services and the personal information stored on them. To improve the cyber security of individuals and families, the NCSC recommends [32] an array of technological solutions: strong passwords, stored in a browser, two-factor authentication, updated devices and frequently backed-up data.

While these are familiar and sound guidelines, they fall short of the security guidance needed in the scenarios presented in our research with community hubs and underserved people. For example, recommending that a family updates its devices presumes they have the financial resources to purchase new devices, and/or the cognitive capacity and sufficient time to negotiate an upgrade of the operating systems on their devices. Backing up data and two-factor authentication similarly depend on sufficient resources to fund cloud storage (or a back-up drive) and the time and cognitive capacity to undertake what are relatively complex tasks.

To revisit the findings of the social change charity cited in our introduction, an estimated 10 million people lack the basic foundational skills needed to access online services [1]. Recognising this, through the Research Institute of Sociotechnical Cyber Security [33], NCSC has supported and taken part in research programmes related to digital responsibility and accessible and inclusive forms of security to better understand the security dimensions of the digital divide.

6 Conclusion: A Case for Kinder Narratives of Digital Security

In this chapter we have drawn from a case study and a literature review to build a case for a more holistic understanding of digital security in the wake of the COVID-19 pandemic. Academics, community practitioners and policymakers must now work together to co-develop the next generation of security guidance that produces safer forms of digital inclusion for both people and technology.

As part of this co-production effort, our case for kindness is a case for inclusiveness and more holistic narratives of digital security, as illustrated by the positive security approaches brought up in our research. To move security forward and better address the disproportionate impact of COVID-19 across the digital divide, we recommend that the narratives driving the design of online systems and the security measures consider the following:

– People who are unable to access online services because they lack appropriate infrastructure
– People who lack sufficient skills and know-how to manage sequences of online tasks
– How trust relations are built, sustained and improved to help people seek and secure support in accessing online services
– The role of voluntary and third sector organizations in building trust and supporting peoples' access to online services
– Digital literacy within those voluntary and third sector organizations and more generally among those providing informal or formal assisted access to online services.

Such a call to action requires a broader perspective on how access to digital services takes place. At its core, this call to action is asking for our understanding of responsibility for secure digital access to be re-examined—and to conceptualise secure digital access as a form of public good.

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The Professional Practice of Type Designers in the Design of Variable Fonts

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Abstract The insertion of technologies in the professional practice of design has provided new areas of activity. The fields that support the professional design practice are different, such as typography, responsible for transmitting written messages and creating typefaces. The typographic scope was also boosted by computerization and digital tools. As a result, font formats began to be developed to allow greater flexibility and the use of typefaces in digital media, such as variable fonts. This format consists of a technology where different widths, weights, slopes, and many variations are incorporated into a single file. There are a lot of ads about variable fonts. However, studies that point out their development processes are still scarce and fragmented. In this perspective, this study aimed to identify indicators and components of the design process of variable fonts. For this purpose, a prospective qualitative investigation was carried out based on the application of questionnaires and interviews with type designers and specialists from different locations and experiences. As a result, it was possible to identify, distinguish and characterize specific components and procedures of the production process of the variable fonts, such as carrying out tests and verifications, structuring the design space, the relevance of adopting a flow for the process, and defining the context of the use of fonts and the contribution of external agents to the type designer in the production of variable fonts.

Keywords Typography · Type design · Variable fonts

1 Introduction

Recognized during the Industrial Revolution, design is an area of knowledge that explores human relationships with artifacts and languages to increase the quality of

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products undergoing industrialization. With it, it is possible to conceive technologies and meanings that influence society's daily life [1]. Much has changed since the origin of the design. Cardoso [2] understands that the change that most affected the practice in this area was the insertion of information technologies. Diagramming tools, rapid prototyping technologies, and the diffusion of the internet brought new elements, increased the possibilities of manipulating graphic resources, and provided new areas of activity.

According to Maeda [3], the evolution of design can be explained in three stages: Classical Design, Design Thinking, and Computational Design. Classic design is about originality, aesthetics, and function and finding ways to put form and function together. Design thinking is a creative, human-centered approach to problem-solving, close to management consulting. Computational design is related to programming languages and interaction patterns.

Some fields of design are linked to the practice of production and dissemination of information, such as typography, which for many years has played a fundamental role in the composition and presentation of texts and written content. For Heller [4], typography is the most important element of graphic design as it conveys most messages. For design, technological innovations have provided significant growth in this field. With computerization, the typographic scope changed and was boosted by the use of digital tools [5]. In this sense, digital font formats began to be developed to allow a greater diversity of use and storage capacity [6, 7].

To provide more flexibility to the types and greater use of them in digital media, variable fonts were launched at the ATypl conference in 2016. They consist of the implementation of OpenType[1] technology in which different widths, weights, skews and many other variations such as color are incorporated into a single file. Thus, they present several benefits, since they can be used in different ways with different shapes and sizes and can automatically adapt to the context in which they are applied [8, 9].

The introduction of digital technologies has also made the type design process more accessible. However, even with the facilities provided by software and development tools, the process is still complex and demands different steps for a consistent result. According to Cheng [10], there is no single or correct process to create a typeface. For the author, the individual methodologies are as unique and varied as the letter designs themselves. Regardless of the development sequence of types, Scaglione [11] points out that, defining a flow, a process, or adopting a methodology for the development of a type design project, makes the work faster, avoids redundant work, in addition to the systemization of the design decision making. In this sense, Mena [12] reinforces that following a process with an adequate structure, whose guidelines lead to the necessary decisions for the project, helps to find an appropriate form for the characters of a typographic project.

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[1] The current specification consists of the 1.8.4 version, with the 1.9 version being ready since May 2021. Available online at https://docs.microsoft.com/en-us/typography/opentype/spec/otvarcomm onformats.

When analyzing methods, processes, and academic reports of the development of typographic fonts and variable fonts, it is possible to notice that they go through similar phases and sequences to achieve their creative and strategic purposes [13]. In a broad view, it is possible to identify three major moments in the development of a digital and variable font. First, there is the elucidation of the problem, the search for references, materials, their analysis, and the definition of the purpose of the types. Next, the exploration of the form of the letters begins, with manual and/or digital drawings, until obtaining the desired result for the main characters of the font, mainly from those that have stems and distinctive parts and that serve as the basis for the construction of the other glyphs of the font. In the same way, the font metric is identified, which will guide the design of the other characters. With this, the character set is made in its entirety, and spacing, kerning,[2] and hinting[3] are adjusted (which can be done automatically with the help of software). Finally, there is the time to generate the font file, test it in operational systems to prove its effectiveness, develop a specimen, a document that presents a font summary, to present its potential to potential users, and publish the font.

It was noticed, during the integrative review of the cited literature [13], that the identified processes are mainly connected to the construction of the characters and glyphs of the digital font without approaching context and project requirements with the same degree of detail. Considering the understanding of Moraes [14] regarding the need for design processes with a broader view, seeking to address not only questions about the product itself but also to understand the dynamics that surround this product, it is intended with this study to identify indicators and components of the design process of variable fonts based on a prospective qualitative investigation through the practice of type designers.

2 The Digital Type Design

From the emergence of electronic communication, between the late 1960s and early 1970s, types began to be experimented within the digital environment. In 1967, Wim Crouwel developed an alphabet with letters built-in straight lines. This allowed a great display on video screens, where curves and angles are represented by horizontal scan lines, which the author called "new-alphabet" [15].

Also, with the popularization of low-cost personal computers and printers in the 1980s, typographic tools reached a wider audience. Until the mechanization of the printer, the shapes of the letters and their arrangement in space were the result of the adaptation of the technology existing at the time and the technique required, depending on its intended use [12]. As early as 1981, digital fonts began to be offered by the company Bitstream and then by Adobe [15, 16]. Later, in the early

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[2] Kerning is the process of adding or removing spaces between specific letter pairs.

[3] Information contained in the fonts that modify the shapes of the characters when presented in low resolution, adjusting the quality of the typographic design to the rasterization matrix.

1990s, the design of types by contour began, as it is today, being able to consider several devices, not only those of low resolution [15].

Advances in digital technologies over time have stimulated the constant growth of type design [16]. Therefore, changes have emerged to improve and facilitate composition with digital types. The OpenType format, introduced in 1996, was developed by the Adobe and Microsoft companies to improve the TrueType[4] format, allowing greater flexibility of use and storage capacity. However, the first families in this format were only released in 2001. OpenType fonts are cross-platform and can include more than 65,000 glyphs,[5] increasing support for several languages, in addition to involving alternative characters, tail letters, ligatures, among other variations, which can be identified and replaced automatically with this file type [6, 18].

In the 1990s, Adobe launched the Type 1 Multiple Master technology [19]. Based on 4-axis interpolation—height, width, optical size, and style—the Multiple Master technology intended to allow Adobe software users to generate font variations to use in their projects [20]. The feature was discontinued, but the technology is still being used today by type designers to assist in the creation of typefaces since with this feature it is possible to generate an entire family from just two font designs.

In 2009, web fonts appeared, or woff (web open fonts format) format. This format was developed by companies like Mozilla, Type Supply, LettError among other organizations, to allow the user to view the fonts used on a website without having them installed on their computer. With this, it was possible to resolve the licensing issues that limited the use of fonts on websites. The woff format made it possible to compress TrueType or OpenType fonts by up to 40% and is the only one that meets the W3C recommendations [7].

The evolution of typography and, consequently, of type design, allowed several changes and innovations for the area, as well as the launch of variable fonts in 2016 from a consortium between Adobe, Google, Microsoft, and Apple. Pamental [21] explains that variable fonts are a new technology where different widths, weights, slopes, and many other variations are incorporated into a single file. That is, in a traditional font family, also called static, each variation corresponds to a different file. For example, a family with regular, italic, and bold variations needs three files. In this case, it's the type designer who determines how heavy the bold type will be and how much lighter the regular type will be. Still, the variable fonts differ from traditional typefaces by saving storage space, since several variations are allocated in a single file [21]. A family of static fonts tends to need more storage space than a variable font, as shown in Fig. 1. It is noteworthy that variable fonts can be text or display fonts.

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[4] TrueType was the first public font file type that provided a scalable font technology, which allowed for a much better display of on-screen type compared to pre-made bitmaps in fonts before this one [17].

[5] Glyphs are specific designs that each character or sign can assume. In turn, a character is the smallest semantic unit of the language. In this way, a character can assume several glyphs—such as more than one variation for a letter—or even a glyph can contain more than one character—for example the ligature "ffi" [18].
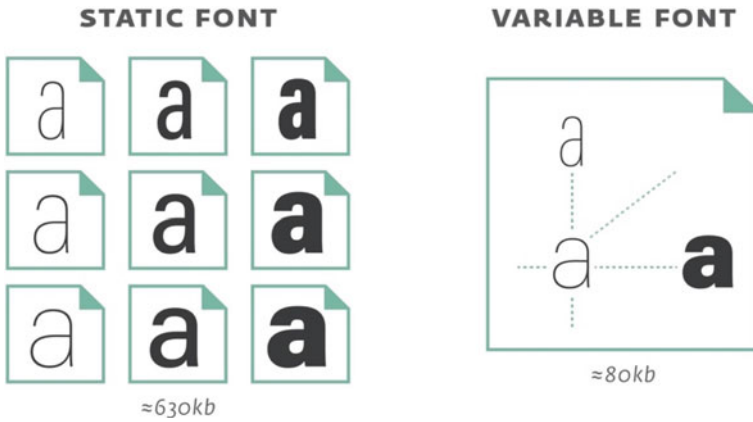
Fig. 1 Difference between quantity and weight of files of traditional typefaces and variable fonts

Fig. 2 Masters and instances in a variable font

Thus, in variable fonts, it is up to the user to choose the weight variation (or other variation axes available in the file) that he wants. Therefore, the font's user will have access to all the intermediate variations between the extremes. For example, in a typeface, you can have light, regular, bold, and extra-bold weights. In a variable font, there are all possible weights between two masters, and you will adjust the weight according to your need. You will not have the fixed possibilities as in the static families (Fig. 2).

There are many announcements about variable fonts and their potential compared to other typefaces [19, 21–23]. However, studies that point out the purposes, development processes, and use of variable fonts are still scarce and fragmented.

3 Methodological Procedures

To understand the practice of type designers in the development of variable fonts, a questionnaire was initially applied with type designers and specialists in variable fonts [24]. Subsequently, to broaden the understanding of the design process in question, interviews were carried out with the same audience.

Fig. 3 Research procedures
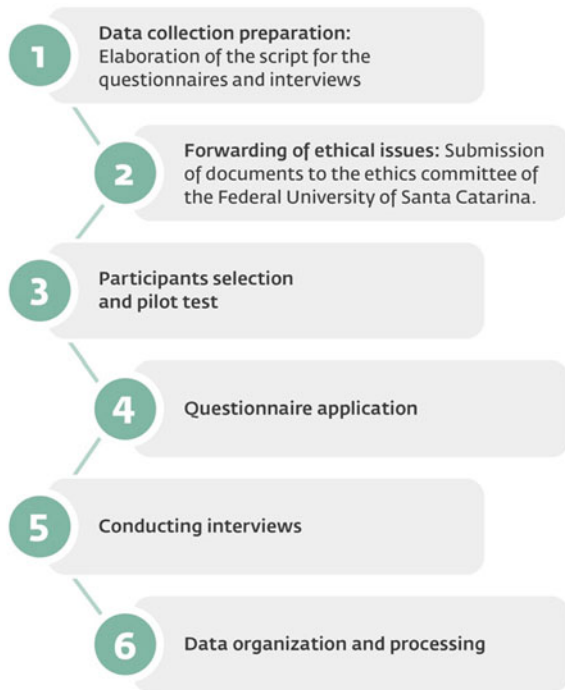
Thus, the present phase of the research was divided into six stages: data collection preparation, forwarding of ethical issues, participants selection and pilot test, questionnaires application, conducting interviews, and data organization and processing (Fig. 3).

The questionnaire and interview script were divided into two main parts. Initially, we sought to identify the profile of the participant and his experience with type design. Subsequently, we sought to gather information about the design process of variable fonts and the context in which the professional works. All questions were open-ended, where the participants could state what they considered to be the most appropriate in each question. In addition, the participants were asked about the type design methods and processes used by them, the decisions made during the variable font design process, and how some aspects influence this process. To verify the clarity of the script constructed, a pilot test was carried out with one of the professionals selected to participate in the research. With that, the script was refined.

The selection of participants was based on their proximity to the practice of type design, electing, mainly, those who have already published variable fonts, who have already been awarded for their fonts, or who work in prominent companies in the scenario of digital font production. Thus, 19 professionals were invited to answer the questionnaire and another 13 were contacted to participate in the interviews.

For the analysis and synthesis of the data obtained in the interviews and questionnaire, we used the method of content analysis and the technique of categorical

analysis proposed by Bardin [25]. According to the author, this technique makes use of coding, classification, and categorization processes through the dismemberment of the text into units and codes classified and regrouped in categories based on analogies. Bardin [25] explains that categorization deals with the classification of the elements of a set and their regrouping according to previously defined criteria, thus forming the categories. This process explores the domain, in a deductive way, to determine the most comprehensive classes within a theme.

4 Results and Discussions

Given the research strategy adopted, 9 questionnaire responses were collected from professionals of different nationalities, namely, 5 type designers working in the United States, 2 type designers in the Netherlands, 1 working in England, and 1 in India. Subsequently, 10 interviews were carried out with 5 type designers working in Brazil, 1 working in Germany, 1 in Spain, 1 in Argentina, 1 in Portugal, and 1 working in the United States. Analyzing the participants' profiles, it is possible to notice that most of them have some training in the area of design. Among the 19 professionals consulted in both collections, 14 have this relationship with the area. It is also possible to observe other formations, some close to design, such as art and architecture and urbanism (Fig. 4).

When comparing the profile of the two groups consulted during data collection, the interviewees and the participants of the questionnaire, it was possible to perceive that, in general, the professionals who answered the questionnaire had more time working with type design than those who were interviewed for this research. By taking an average of the interviewees' work time, there is an experience of 7 years, while the average time of work with type design of the professionals who joined the questionnaire is 24 years.

To understand the design process of variable fonts, data collection had six main research themes, namely: methods and process of variable fonts design, the definition of project requirements, design definitions of variable fonts, variable fonts design, quality of instances of variable fonts, and project completion. The collected data related to these themes were coded, classified, and categorized into twelve groups of codes. Thus, the participants' responses were coded and these codes were related to
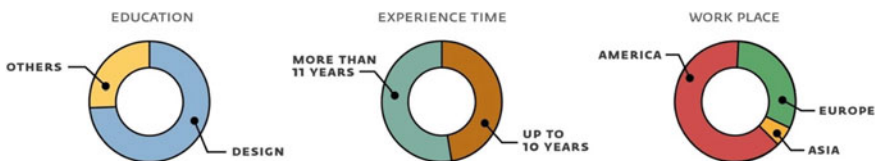
Fig. 4 Profile summary of professionals and experts consulted during the research

QUESTION THEME:

**DESIGN DEFINITIONS
OF VARIABLE FONTS**

▼

PARTICIPANT RESPONSE (EXAMPLES):

*(…) The **axes choices** are related to the benefits of variation to the project (…)*

*(…) I try to **define axes** that are functionally useful for the user to control, or give the design a wide range of customizable personality (…)*

▼

CODE:

AXES: DEFINITION OF THE VARIATION AXES

▼

CODE GROUP:

DESIGN SPACE
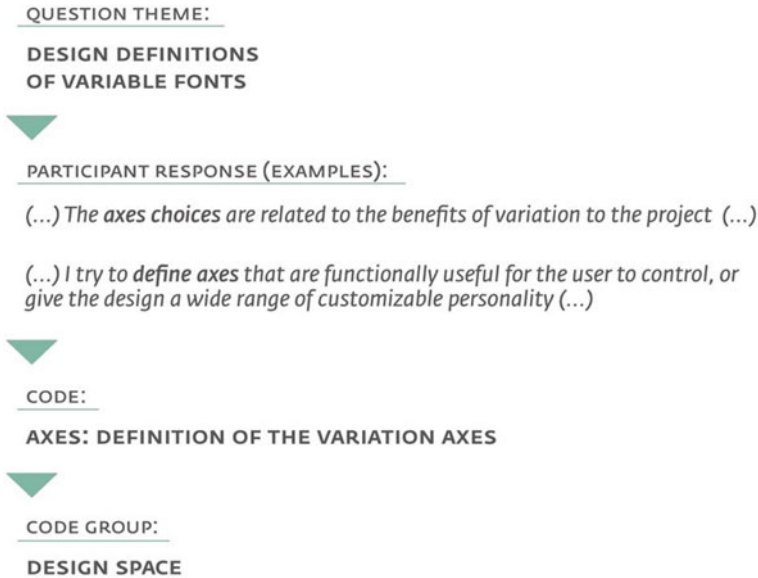
Fig. 5 Example of the coding and categorization process

the research topics. Based on the proximity and similarity between the codes, it was possible to categorize them into thematic families, as shown in the Fig. 5.

The code groups identified during the aforementioned data collection were: process steps, research, project types, typography features, the context of use of fonts, design space, character design guidelines, file preparation, distribution, disclosure, third parties, and tests. Table 1 presents the groups of codes and the number of times they were cited in each research topic and throughout.

The **process steps** reflect stages of the production of variable fonts and reinforce the need for a flow for the design process of variable fonts. This component was identified in the participants' answers when they presented phases and steps adopted in projects with variable fonts, such as generation and incubation of ideas, sketches of the letters, choice of the test word, and expansion of the character set.

The **research** deals with the search for typographic references, market gaps, and type foundrie and inspirations. With them, it is possible to define the purposes and objectives of the variable font project. In turn, **project types** reflect the various possibilities of a typographic project. Data collection presented two main types, namely, original projects and typographic rescues.[6]

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[6] The **type revival** can be understood as the reuse of a typographic design created and used originally from old technologies, normally already in disuse, for application in contemporary technologies. A font designed from a type revival seeks to preserve the essence of the original design to different degrees, being able to only reproduce the types or reinterpret them maintaining their main characteristics.

Table 1 Interview codes and questionnaires were added considering the main themes of the interviews and questionnaires concerning the design process of variable fonts

Categories (Code groups)	Methods and process of variable fonts design	Definition of project requirements	Design definitions of variable fonts	Variable fonts design	Quality of instances of variable font	Project completion	Total number of occurrences (citations) by category
Tests	10	4	2	0	49	17	82
Design space	6	6	23	17	0	0	52
Process steps	36	5	0	1	0	0	42
Context of use of fonts	1	25	7	0	0	0	33
Third parties	1	5	0	0	1	14	21
File preparation	8	0	0	0	0	12	20
Typographic features	3	7	5	0	0	0	15
Character design guidelines	0	0	1	10	3	0	14
Distribution	0	0	0	0	0	14	14
Disclosure	0	0	0	0	0	13	13
Research	1	11	0	0	0	0	12
Project types	2	0	0	0	0	0	2
Total							320

Typographic features refer to character and glyph[7] design properties and attributes. Therefore, they take into account both the formal characteristics of the letters, for example, the presence of serif, the proportions between characters' parts, the thickness of the stems, among others, as well as the conceptual and expressive characteristics of the typefaces, such as seriousness, formality, relaxation, etc.

The **context of use** is related to the type of media and the functions for which the variable font is designed and assists in defining the masters and axes of the variable font. In turn, the **design space** directly refers to the axes of variation and extremes of the variable font. These are usually visually organized in a structure that allows understanding the possible instances of design existing between the masters.

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[7] Glyphs are all graphical representations that configure characters. That is, a character is a semantic unit, while the glyph has a graphical meaning. A font can have different glyphs to represent the same character [26].

The **character design guidelines** clarify rules that must be followed so that the connection of the axes is possible. In this sense, defining metrics, verifying the quantity and placement of the points of the vector drawing of the glyphs will provide the operation of the variable font as such. Thus, the guidelines act as basic parameters for the construction and performance of the variable technology.

File preparation deals with manipulating the font file to make it available for use. Therefore, it involves defining metadata[8] and font information, improving drawing processes for on-screen viewing, and exporting the final file. Disclosure involves the creation of materials for the presentation of the font to possible users as well as its attributes and the different possibilities available through the axes of variation. Regarding **distribution**, how the variable font will be made available to users is defined. In this sense, some possibilities are the distribution in large distribution and sale networks of fonts and the type designer's and type foundries' websites. In this regard, the professionals consulted also highlighted the preparation of licenses for variable fonts, a document that presents how the fonts can be used.

The **presence of third parties**, or agents external to the type designers, during the design process of variable fonts, marks the collaboration of other professionals during the different stages of the project, as well as potential customers. The project can be forwarded by third parties and benefit from opinions, vision, and use by third parties concerning the variable font being developed, being some specialist (such as post-producers of fonts, other type designers, graphic designers) or not.

Finally, the **tests** deal with the verifications made during the design process of variable fonts. Concerning them, several possibilities were highlighted by the professionals consulted. Print tests, final checks, constant revisions, instance tests, and specific glyphs were scored and, in addition, there was an emphasis on the verification of the font being developed in digital media. Some of the possibilities are tests on platforms developed for this purpose, simulating the fonts being developed on websites and in different screen sizes.

By adding the citations (participants' answers coded), referring to the groups of codes and the research themes resulting from the interviews and questionnaires, it was possible to verify the recurrence and, consequently, the influence of each group in the design process of variable fonts. Given the data presented in Table 1, the importance of **tests**, the **design space,** and the **process steps** for the design of variable fonts is verified, since these were the three categories most addressed by the professionals consulted (Fig. 6) that illustrates the distribution of codes for each category identified in the data resulting from the interviews and questionnaires.

By relating the generated categories with the main themes addressed in the research, it was possible to visualize the influence of each category according to the subject addressed, as shown in Fig. 7.

Analyzing the categories in isolation, it is possible to notice that the tests were mentioned in more themes addressed in the research, in five of the six themes referring to the design process of variable fonts (Fig. 8).

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[8] Metadata involves the file name and variable font family, authoring data, font version, and naming and configuring instances and styles.
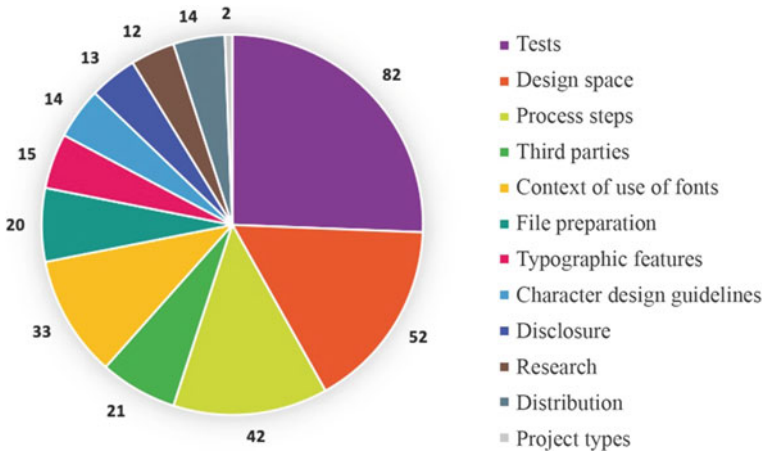
Fig. 6 Aspects addressed by the professionals consulted considering the main themes of the interviews and questionnaires concerning the design process of variable fonts
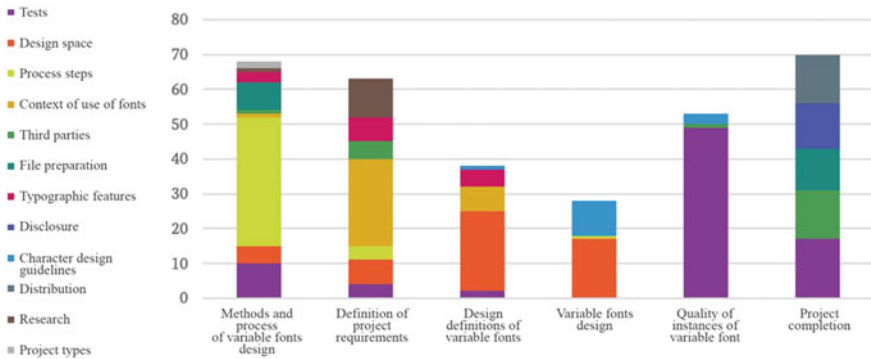
Fig. 7 Relationship between the aspects addressed by the professionals and the main themes of the research
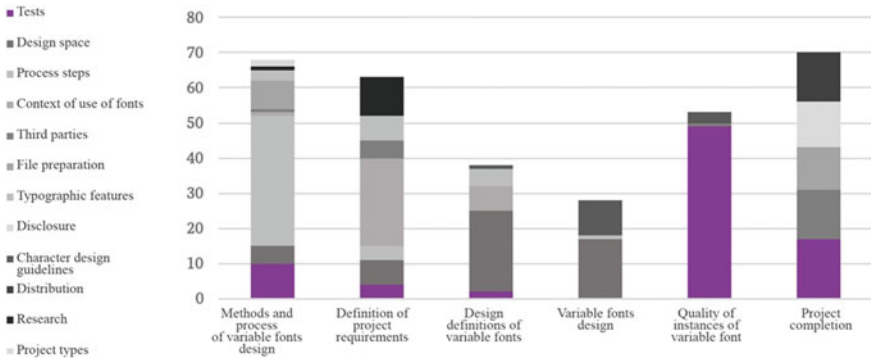
Fig. 8 Recurrence of tests during the variable fonts design project
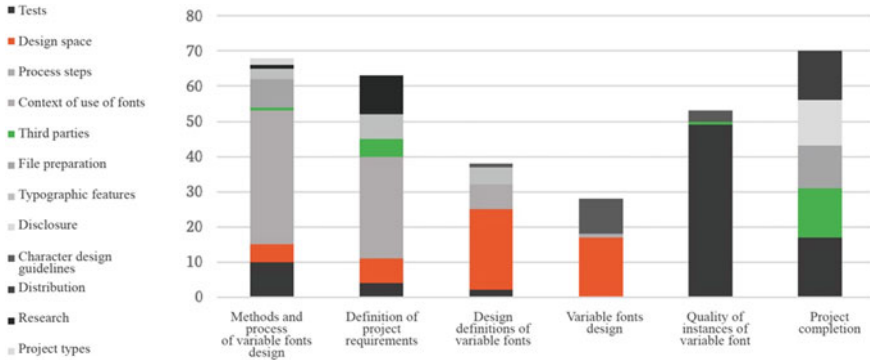
Fig. 9 Recurrence of tests during the variable font design project

Therefore, in addition to being addressed in the theme of methods and process of variable fonts design, according to the participants, the tests are taken into account in the definition of project requirements, the questions related to the variable fonts, and in project completion. The biggest recurrence is in the influence of the tests for the quality of instances of variable font.

It is also observed that the tests, in addition to being addressed in more themes, were also addressed in more citations, in contrast to the literature. It should be noted that among the processes and methods of typefaces and variable fonts design analyzed in previous research [13], the number of processes that suggest this verification procedure is insignificant, which highlights the gap between the literature in the area and the professional practice of type design. Given, it is understood that the tests and verifications during the design project of variable fonts must be present throughout its course, these being fundamental to provide a quality result.

Next, the categories that appear in four of the six themes explored during the research are the **design space** and the **influence of external human agents on type design** (Fig. 9).

In this sense, it is noteworthy that the category of **design space** was addressed in the theme of methods and process of variable fonts design, concerning project requirements, variable fonts design, and, more recurrently, related to design definitions of variable fonts. This issue was the second most discussed during the research concerning recurrence in the participants' answers. However, it can be seen that it was little explored in the bibliographic findings [13], not being highlighted as part of the process in any of the methods and processes consulted.

In turn, the presence and influence of **third parties** during the design process of variable fonts was addressed in the theme that raised methods and process of this type of project, in project requirements, in quality of the instances of the variable font as well as in project completion, the latter with greater recurrence. Likewise, this issue was not found in the consulted literature [13]. Thus, it is concluded that the influence of human agents external to the type designer is also an aspect that permeates the entire design process of variable fonts.
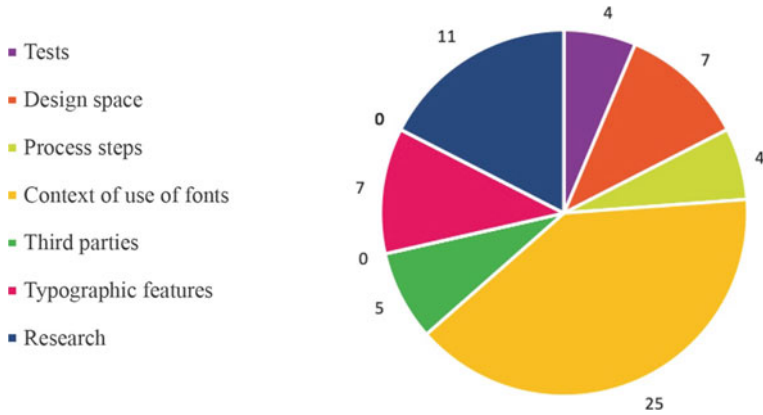
Fig. 10 Aspects identified in the research that influence the project requirements

With the prospective research, it was also possible to relate the most relevant aspects in each of the themes that refer to project moments. Therefore, concerning the **definition of project requirements**, it is possible to perceive the greatest influence of the category of the context of use of fonts, research, typographic features, and design space in descending order (Fig. 10). Regarding the context of use, it is possible to highlight its influence on the design process of variable fonts, given that it was the fourth most addressed item in the participants' answers during the research. However, the relationship of this definition with the practice of type design is rarely addressed in the literature.

Regarding the **specific issues of variable font projects**, there was an emphasis on the categories of design space, the context of use of the font, mainly concerning applications in digital interfaces, animations, editorial design and visual identity, and typographic features, in descending order (Fig. 11).

When the subject was **variable fonts design**, the research participants mainly dealt with the categories of design space, in most answers, and the character design guidelines, which should be considered at this time of the variable font design (Fig. 12).

Finally, when dealing with **project completion**, the categories of tests, third-party participation, distribution, disclosure, and file preparation were scored in similar recurrences (Fig. 13).

Given the above, it is possible to summarize the main contributions of the professionals and experts consulted concerning the design process of variable fonts:

- **Tests**: the verification of the ongoing process proved to be essential to guarantee the quality of the instances of the variable fonts. Still, it is possible to perceive that this aspect is present in different project moments, its consideration being relevant throughout the project.
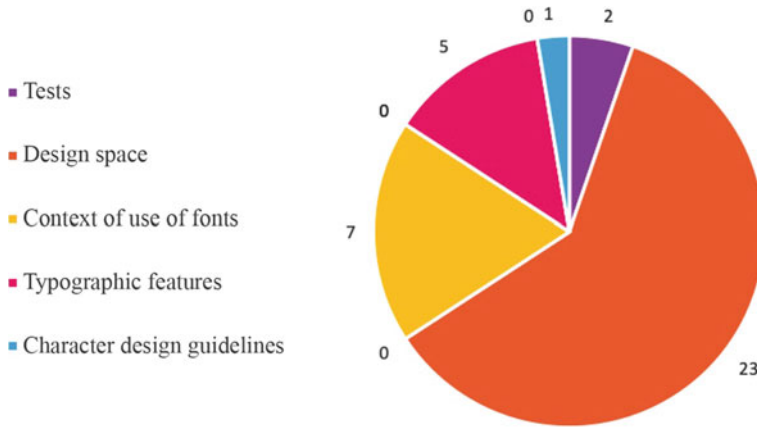
Fig. 11 Aspects that influence the design definitions of variable fonts
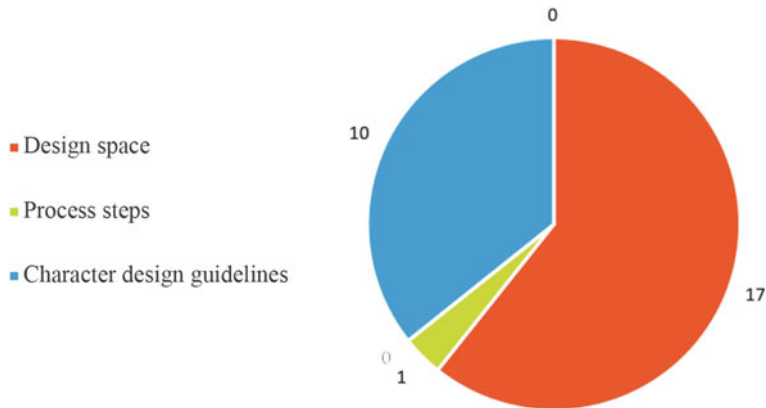
Fig. 12 Aspects present in the variable font design stage

- **Design space**: as it involves aspects of variable fonts, the design space had a notable presence during the research, reinforced mainly at the time of variable fonts character design.
- **Importance of steps to organize and guide the process**: all participants explained the design process of variable fonts in stages, phases, and project moments, demarcating the relevance of adopting a process, method, or flow for the production of variable fonts.
- **Context de use**: the planning of variable font application proved to be relevant for the entire development of the project, explored mainly as a project requirement by the professionals consulted.

- Tests
- Third parties
- File preparation
- Disclosure
- Distribution
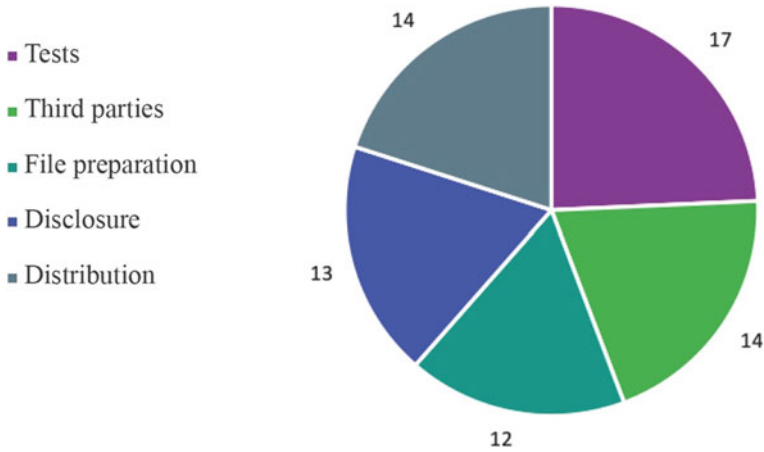
Fig. 13 Aspects considered in project completion

- **Third parties**: the presence, participation, and collaboration of human agents external to the type designer stood out during several moments of the project, their presence being significant during the design process of variable fonts.

5 Final Considerations

The advancement of technology has brought changes to the area of design to provide new experiences to users. As a result, different fields have undergone developments resulting from computerization, such as typography, where the processes of creation and application of typefaces have been adapting to new communication formats. Given the new typographic formats developed to provide more flexibility and use of digital fonts, such as variable fonts, it is understood that it is necessary to understand the flows and processes of their production. From this perspective, the present study aimed to identify indicators and components of the design process of variable fonts based on a prospective qualitative investigation based on the practice of type designers.

From the application of a questionnaire and conducting interviews, it was possible to identify components that are part of the design process of variable fonts. The research results allowed us to elucidate aspects about this process not found in the literature. Also, it was possible to distinguish and characterize specific procedures in the production of variable fonts and mark the relevance of the components of the design process of variable fonts.

Regarding the data collection methods adopted, it is pointed out that the questionnaire presented as positive points the ease and practicality of sending. However, one of the perceived weaknesses was the ease of misinterpretation of the questions and the impossibility of generating new inquiries for further study. This point was

repaired by conducting the interviews since it was possible to generate new inquiries to deepen the questions according to the interviewees' answers. In addition, it is noteworthy that the interviews presented as positive points the possibility of accessing subjective data brought by the participants, their experiences, opinions, and practices in type design.

Among the limitations of the study, the small sample size is highlighted. Furthermore, it should be noted that the results are conditioned to the particular universe of this sample, considering the experiences and practices of the experts consulted concerning the design of variable fonts. As an indication of future research, it is possible to highlight the expansion of professional participation and the use of focus groups to discuss the consistency of the data presented in this research.

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Pedagogy, Society and Design Practice

Inclusive Design is Much More Than the Opposite of Exclusive Design

Fernando Moreira da Silva

Abstract For the last 30 years, designers and researchers have been discussing and practicing a design with the concern of not excluding anyone, or at least including the largest possible number of users, always with their participation throughout the process: it became known as Inclusive Design. All projects that do not meet these principles are now considered exclusive. However, the vision, culture, strategies, quality requirements and the inherent needs of a socially responsible design have been changing in recent years. Developing inclusive design products and services has become a challenge not only for designers but for all stakeholders involved in the process, requiring greater knowledge of methodologies to be used, processes, tools and procedures. The present document intends to be a call for attention to the issue, based on our personal experience as a designer and researcher, with the main objective of discussing and reflecting on basic and fundamental concepts inherent to Inclusive Design.

Keywords Inclusive design · Participatory design · Exclusive design · Empathy

1 Introduction

Inclusion has become a concept used regularly and in the most diverse senses. In line with this procedure, Inclusive Design has been studied and used with greater acuity in the last 20 years. Proof of this is the UN's own Sustainable Development Goals [1] (2015), in which the concepts inclusiveness and inclusivity are among the most used throughout the document.

When referring to the concept of Inclusive Design, one automatically thinks of the opposite, that is, Exclusive Design. However, Inclusive Design has been improving and introducing changes in its way of acting that goes far beyond being non-exclusive.

By their very nature, designers have a desire and a responsibility to contribute to the betterment of the world. However, they must be attentive to the paradigmatic

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changes in Design, to the new societal challenges, which mainly involve a new way of thinking, acting, involvement, attending to and incorporating disciplinary diversity and end users, exploring concrete ways of integrating knowledge to obtain solutions closer to the wishes of these same users. This positioning has led to profound changes in the approach to Inclusive Design itself.

Since the late 90s of the last century, this theme has been central to our investigations and ways of designing in design, so we consider it imperative to contribute with this text to the understanding, reflection and clarification of what Inclusive Design is or what it's all about when we act with a focus on inclusion through Design.

2   Inclusion and Participatory Design

One of the most important ways to promote inclusion is Participatory Design. It is a form of effective participation of non-designers in a design project, with a special focus on end users. According to Muller and Druin [2], we can say that participatory design is a design process where the end user contributes to the development and life cycle of the product or system, through his/her perspectives and needs. It becomes a higher form of involvement, with the transfer of part of the decision-making power to the user, especially at the level of exploration of the characteristics and validation of the product, which can be not only decisive for its success but also very important for the user self-esteem.

The participatory design approach, where the end user is included in the team, make it interdisciplinary. Users' active participation goes far beyond using them as a data source, submitting them to questionnaires or observing how they use a particular product or service. It is believed that in a participatory project, one must have a global notion of the users themselves, contextualizing it through each one own individual, social, cultural and historical reality.

When designers resort to the practice of Participatory Design, they make possible the involvement with a context that is sometimes unknown or little explored before, it shows the importance of immersing in a new environment, it cultivates new bonds of trust and familiarity, building a new relationship with the chain of value, which makes it possible to expand action opportunities and optimize resources.

Through external participation, it is possible to design based on the capabilities and needs of the other and move away from pre-established concepts. When the scope of social issues in which the project is really inserted is understood, it is possible to design skillfully for the complexity of the world, relying on a collaborative network in the projects. Thus, resorting to a way of designing in which future users have decision-making power represents a movement in which different points of view can combine with the designer's gaze to generate an innovative solution.

According to Pilemalm et al. [3], participatory design approaches have their origin in the 1970s, when they were used as a means to empower workers in the workplace, allowing them to take part in designing the technology they would use. Carroll and Rosson [4] state that in the 1980s, the direct participation of the end user was still

almost absent from conceptions at the level of design centered on the Human Being. It was not before the 1990s that participatory design practices became more common, understanding the advantages of designing with and for the users, becoming one of the pillars of interaction design. In this way, it became easier to understand how products and systems are used, and the impact they have and the empathy they have on the end user.

At the end of the last century, Papaneck [5] also advocated the importance of participatory design: for him, the designer's job is to provide real and meaningful choices, so it is necessary to allow people to participate more fully in the decisions of their own lives, enabling them to collaborate with designers in the search for solutions to their own problems. There is a paradigm shift from *design for people* to *design with people.*

A key point of the current discussions is the approach to design from the perspective of the stakeholders involved, in order to create and promote forms of interaction and innovative partnerships between all, which requires new skills from the designer, such as operationalizing and facilitating processes of participatory design in which entrepreneurs, users, institutions, community and others participate, directing this process towards sustainable and inspiring solutions.

Carroll and Rosson [4] state that participatory design has great relevance, as it integrates two propositions about the project: moral and pragmatic. The moral proposition concerns the people whose activities and experiences will be most directly affected by the design solution, who should have the right to be directly included in the design process. The second, pragmatic proposition, is that the people who will have to adopt and perhaps adapt to a particular product or service must be included in the design process so that they can offer more perspectives and preferences to designers, increasing, thus, the possibilities of a successful project outcome and greater empathy.

Some people confuse Participatory Design with Collaborative Design. Participatory Design focuses on management philosophy, as it answers the question: *Why do it?* Thus, when we think of a people-centered approach, motivation is fundamental to achieve good results; thus, the answer provides such a purpose. While Collaborative Design seeks to answer the question: *How to do it?* A design and/or creative process generates innovation, so Collaborative Design answers the question of how to do it.

Among the various tools that Participatory Design can use, there are two very important ones for the development of team building, which are: Brainstorming, a group dynamic that explores creativity, where people give free ideas about a subject or a problem previously established; and the Empathy Map, a tool that enables a deeper understanding of people, their behaviors, their opinions and the systematics of their lives.

We can say that Inclusive Design distinguishes itself from other ways of developing products For All, because it acts in an interactive way, always incorporating end users in its processes, so, given our research and design experience its best strategy is Participatory Design.

3   Technology and Exclusion

Over time, technology has allowed extraordinary advances and sometimes at a speed that is difficult to keep up with. Designers, who most of the times help in its development or use it for the development of their products and services, are often unaware of the difficulties experienced by individuals who have some type of disability or who belong to more aged sections of the population.

We know that those who do not master new technological tools often lose autonomy, empathy and even interest in a particular product. In this sense, it is essential to make efforts on the part of all designers, in order to avoid the exclusion of a large part of society that is increasingly surrounded by technology. It is, therefore, of great importance to carry out studies which allow the identification of the special characteristics of the entire target of products and services in order to be able to consider and attend to them in their development.

Another very important aspect that must be addressed in the process of inclusion of people with disabilities or the elderly is the way they face technology, mainly identifying episodes in which the feeling of resistance, limitation and incapacity can lead to loss of self-esteem and refusal to use technological products or products that use a certain type of technology. According to Litto [6], there is an important relationship between self-esteem and the use of technology: self-esteem plays a relevant role in the process of appropriation of new technologies by these target audiences, in which the ability to master a new skill leads to the growth of self-esteem.

The usability of a given product or system is a measure of the quality of the interface, in terms of ease of use, interactivity and learning. Usability and user experience are associated with user characteristics, activities and tasks to be performed, equipment and physical environments.

The product or interface must, depending on the context, adapt itself to the user and not the other way around; otherwise, it may cause the exclusion of part of its users, becoming an exclusive design product. The adaptability of a product or system concerns its ability to respond to user needs and preferences. For this to happen, as already mentioned, the involvement of the user throughout the project is essential, that is, from the phases of analysis or survey, conception, design, development, implementation and revisions [7].

The use of technology has become one of the great contemporary challenges, especially for large portions of the adult population. In order for technology not to be an exclusion factor, an interdisciplinary, ethical approach, focusing on the vast majority of target users, is necessary so that motivated communities able to face the challenges of our time are developed.

4 Empathy and Ethics Are Inclusive Design Needs

Remarkable things can happen when empathy for others plays a key role in problem-solving.

Design empathy is an approach that draws upon people's real-world experiences to address modern challenges. When companies allow a deep emotional understanding of people's needs to inspire them—and transform their work, their teams, and even their organization at large—they unlock the creative capacity for innovation, through concepts, products, services, strategies, and systems that are both innovative and responsive. Design empathy benefits can reach more people and have long-term positive impact on actual user needs and desires.

In the late 90s empathic design was described as a cultural shift. Meanwhile, various disciplines hailed the importance of considering emotion as not only a valid subject of study, but as one that was crucial to design products [8]. At that time, empathic design was presented as a significant discipline and process involving observation, data collection and analysis, and iterative prototyping, being identified as a way to bring up people's unspoken latent needs and then address them through design, rich of innovation, organizational strategy, and business challenges [9].

Inclusive design is a way to apply empathy in new contexts, from simple products to complex systems, leading to outcomes that are functional and emotionally meaningful for the target people, thus empathic design requires deliberate practice.

Putting ourselves in *someone else's shoes*, empathy causes relevant changes in our cognitive style, increasing our productive thinking, enhancing our ability to receive and process information, putting it in context and picking up contextual cues from the environment.

According to Decety and Ickes [10], we are more helpful and generous after an empathic encounter, and designers' empathetic behavior personally motivates them to solve design challenges.

Focusing on empathy, design teams are more motivated and able to understand users' perspective, what they want and really care about, more human-centered, which can introduce unmeasurable changes in the product or service, even in the business itself, by presenting new opportunities, providing energy to overcome possible obstacles.

Empathic design challenges can be at two levels: product or service level; or at cultural level. Sometimes designers have to use empathy to introduce changes in the process to achieve a good and sustainable product that performs the needs and expectations of the final user. But other times designers have to be the mean to make significant cultural changes in an organization or community, with the resource to empathy.

Designers regularly discuss the best tools, methodologies, processes and forget how the complexity brought by modern times forces them to make decisions that have profound consequences in people's lives.

Ethics seeks to understand and assist in the judgment of what distinguishes a good action from a bad one, what makes an attitude right or wrong, what we must do to act

better. The ultimate goal of an ethical judgment must be to guide a conscious practice of moral and human values. In design, it is not enough to understand well the problem to be solved and find a solution: it is necessary to understand the consequences that a certain decision will have on the life of the target group. Many of the problems that we can classify as ethical problems arise from actions taken without a serious assessment of future impacts.

According to Flusser [11], the ethical role in Design has acquired a new meaning in the current context, and even a character of urgency.

Design ethics has two dimensions: professional and moral. In the case of the former one, it is currently understood as the production of a globally satisfactory solution, accommodating the interests of both the client and the user. As for morale, it is about meeting all possible perspectives so as not to harm the user throughout the process, as well as any other stakeholder involved, if possible, even introducing improvements. Only through the coexistence of both in the exercise of design is it possible to achieve a truly ethical design.

To achieve a more ethical design, designers have to meet some fundamental principles: total transparency and focus on the user; inclusion and accessibility, taking into account the difficulties that the user may have and looking for solutions to extinguish or reduce these difficulties; inclusion of the user in the process, right from the beginning; concern with usability, creating intuitive and easy-to-use products that make the experience pleasant for users; privacy, creating a design that avoids the invasion of privacy; social responsibility, with a design that contributes to the clarification and correct approach to social causes.

5   Inclusive Design Challenges

By definition, Inclusive Design is the design of core products and/or services that are accessible and usable by as many people as possible, regardless of age, gender or ability, and without the need for special adaptation or specialized design.

In an ideal world, inclusive products and services would be the norm rather than the exception. Collaboration between users, designers and producers from the beginning of the project to its completion would be the key to success. However, in the real world this is not so. The main objective of inclusive design is therefore to make life easier for all people. In this context, the designer can have a critical view of the world and adopt a holistic and sustainable approach to the product or service being designed [12].

Human diversity, with its needs and expectations, is a reality that still does not concern the vast majority of people. In the specific case of design, the concept of Inclusiveness still remains unattended in the design and development of a vast majority of solutions and final products.

Dong et al. [13] made an important contribution by organizing the main sources of basic knowledge to achieve Inclusive Design: theoretical models (processes for the project and knowledge transfer); information about users (on the diversity of profiles,

capacities and contexts); examples of good practices (in areas of design, business and education); methods and tools; regulatory documents, standards and guidelines.

It is urgent to use new strategies that allow the different stakeholders involved in the design processes to respond to a postulate, cultural and epistemological change, articulating "knowing how to do" with "knowing how to think", in order to achieve solutions and products that serve the vast majority of users.

As Paula Trigueiros states [14], everyone has the right to design. However, the specificity of the problems that affect the daily lives of sick people, in a situation of disability and depending on others to perform essential tasks, sometimes leads to very complex challenges when thinking about promoting inclusion through design. For these situations, the most comprehensive solutions and products on the market often do not adequately satisfy their requirements.

The deficit in functional capacity, which makes an individual dependent on others to perform daily activities, has different degrees. Although independence is usually used synonymously with autonomy, it is important to mention that some people with reduced functional and physical capacities have the ability to choose and control part of their environment [15]. This means that we will only be able to develop an inclusive design if we attend to the great diversity of the final user for whom we are designing, using our own methodologies, as well as a necessary paradigm shift in the way of being and acting in design project, which goes through a vision and critical behavior, and a holistic and interdisciplinary attitude of the designers themselves.

Inclusive Design is also about finding correct solutions so that people with disabilities or the elderly can use a certain product or service, for which they have evident difficulties or limitations, without feeling discriminated against with the need to use a product that segregates them in comparison with other users, instead of including them. In fact, there are several alternatives in support products, possibly much more functional but that exclude them from using the same products as the others: inclusive design must guarantee users' freedom of choice, allowing them to make the decision to use the same product as the others, using an adaptation, or a support product.

Martelli et al. [16] evidenced that among the elderly there is enormous resistance to the use of gadgets that could make their lives easier, even providing greater autonomy, but which discriminate them against other users. These gadgets, rather than promoting inclusive design, are products that accentuate exclusion.

It should be clarified that Inclusive Design is not Design for Disability. These concepts are often mistakenly confused. Design for disability is the specific search for a solution to solve a concrete problem of a certain type of disability, or even a specific person with a disability, within the tailor-made concept. Inclusive Design is designing including end users throughout the entire process, in order to achieve a solution for everyone, or at least for the vast majority of possible users, whether they have a disability or not.

But designers also have to carefully study products on the market that, with minor changes or adaptations, will serve a greater number of users: this is also a form of inclusive design. As highlighted, nowadays there are several and pertinent challenges that designers have to attend when developing a socially responsible design.

6 Conclusions

Inclusive products and services were never designed in a vacuum, but now everything is more evidently connected as part of a larger ecosystem and interdisciplinarity. We believe the process will evolve and practice empathy will be key to increasing the positive impact of inclusive design. However, all of the stakeholders involved need to be intrinsically motivated if they are going to truly follow through with their commitment to human-centered design and innovation.

Empathy is not only something we facilitate for others but also for ourselves, which leads us to rethink design methods and processes, replacing or augmenting them with empathy-building experiences, which will have an impact on the society, engaging with an increasingly diverse mix of individuals, groups, and contexts.

We believe that Design can only be Inclusive if it integrates new ways of doing and thinking, taking into account a cultural change, incorporating an interdisciplinary strategy, with different types of approach and involving interdisciplinarity people from different areas, and Participatory Design practices; if the principles of Social Responsibility, Ethics and Empathy are respected in the conception and development of products and services, taking into account human diversity and assuming that Design can set an example of what it means to respond to the needs and expectations of the greatest number possible end-users in your projects; if the technology is used without forgetting the universe of those who will use it, so as not to promote exclusive design; if appropriate processes, methods and tools are used for the development of inclusive products, such as User-Centered or Human-Centered Design, Co-Design, among many others; if we bring together the different stakeholders involved in the process and if we implement a cross-pollination of the different concepts and aspects involved in the search for more holistic results and inclusive solutions.

If this postulated change of mentality and a conscious change of attitude are achieved, it will result in a gradual return to balance, where society's behavior can contribute to socioeconomic and sustainable development, in a framework of social responsibility centered on the plural Human Being, with different needs and expectations, that is, meeting the different dimensions of Inclusiveness.

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Sci-Stories in Design: Guidelines for Curricular Inscription and Dissemination Through Visual Narratives

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Abstract   This article aims to present a set of guidelines for the curricular inscription of invisible stories—empirical knowledge, life experiences, professional and pedagogical practice—of Design professionals, lecturers, and researchers, with a role in the history of Portuguese Design, shortening as much as possible, the scientific findings from the corresponding curricular frameworks. It is intended to revert this matter into a pedagogical context, permeating several Curricular Units, in coordination with the faculty thus creating new pedagogical contexts for the students who take part in these Units. A series of workshops in different Design Faculties were conducted to understand the engagement of the students and the degree of empathy they were able to establish with the different topics through visual representation exercises. This reactivation and inscription of these testimonies, from the voice and experience of several design professionals and researchers, aims to connect the current generation of design lecturers, students, and professionals with Portuguese design. To achieve this, we propose two dissemination approaches: (i) learning methodologies will be put into practice aimed at exploring new visual repertoires that offer a critical look to the new generation of design students on the inheritance of knowledge, and intellectual assets, through visual representation; (ii) conceiving a digital archive to increase outreach and perpetuate knowledge. The guidelines proposed will inform new solutions for the dissemination, inscription, and reactivation of knowledge (shaped by memories and experiences) as curricular or extracurricular modules, using visual narratives as a communicational interface.

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1 Introduction

This study introduces itself as an extension of the outcomes obtained at the conclusion of the Science and Technology Foundation (FCT) funded project, "Wisdom Transfer (WT): towards the scientific inscription of individual legacies in contexts of higher education reform and Art and Design research (2018–2021)" [1]. Successfully completed in January 2021, this project aimed to lay the foundations for a paradigm shift in the reactivation of knowledge-relevant contributions that academics and practitioners in art and design, can provide on their own behalf. A golden generation that reflects a "sense of school" that remains alive to this day in the foundations of Art and Design education in Northern Portugal [2]. As John Berger would say, "a people or a class which is cut off from its own past is far less free to choose and to act as a people or class than one that has been able to situate itself in history" [3].

Accordingly, one of the main focuses of the R&D project Wisdom Transfer relied on the relevance and urgency of integrating these results into the curriculum. To fulfil this goal, several actions of scientific and institutional dissemination were carried out, such as journal publications and conference participation (national and international), exhibitions, lectures and seminars, as well as a set of curricular initiatives, in several design courses, such as the Faculty of Fine Arts—University of Porto, School of Design-Polytechnic Institute of Cávado and Ave and Lusófona University, Porto.

1.1 Aims

It is considered of utmost importance to continue this work, replicating the dissemination model to improve the preliminary pedagogical model to, on the one hand, provide a quicker integration of the project research outcomes into the curricula and, on the other hand, obtain from these experiences crucial data for research itself.

These are the main purposes of this study:

- Map, inscribe and disseminate the untold stories and local memories from Design professionals, following on the work carried out in the Wisdom Transfer project and articulated with ongoing research projects. Part of this generation is ageing, which increases the urgency of recording all this information, otherwise it will be irremediably lost if it is not legitimised and activated in the present.
- Integrate the previously selected and organised data, into curricular frameworks of Design education, promoting in-depth research of case studies, in higher education institutions.
- Connect the contemporary Design community to its foundations, recovering history in an era of cancel-culture, simultaneously joining a global debate

on the subject. The creation of an online digital archive, integrating scientific/pedagogical/artistic research findings, will enable design students, lecturers, and practitioners to engage with their predecessors through direct, integrated, free and global access to information.

It is intended to revert this approach into the pedagogical context, either in curricular or extracurricular environments, promoting the ongoing collaboration between researchers, and their corresponding research units, faculty and students. The reinforcement of these relationships, the creation of new pedagogical contexts and the consequent creation of an open access digital archive will contribute to the invigoration of the relationship to the community, academic and non-academic, bringing science closer to the public.

It is important to bear in mind that the foundations of Design education in Portugal were strongly based on international references. This invisibility of Portuguese Design could be explained by: (i) the need to acquire international expertise after four decades of a regime of censorship; (ii) the allure for alternative approaches to design practice; or (iii) the number of Design lecturers educated abroad.

Different authors and researchers in Design, and related fields, have been reactivating these memories and experiences, whether in (i) the first person: Mendonça [4], Santos [5], Howard's Personal Views Series (2003–2013), Bártolo et al. [6] and Cruz [7]; (ii) industry-related: Cunca [8]; or (iii) within a historical context: Fragoso [9] and the Errata Design doctoral research project by Isabel Duarte, FBAUP.

However, there is a clear lack of a collective framework that gathers, documents, and compiles all these memories and testimonies, thus mapping out the practices of Portuguese Design from its origins, framed in both time and space. As pointed out by Adamson et al. [10] "knowledge is always fragmentary (…) and only comes into its own through the unexpected challenges, confirmations, elaborations, and unsettling that result from encounter".

Several reference models are currently in place, under international contexts, such as AIGA Design Archives and The University of Brighton Design Archives, dedicated to British design, and twentieth century design global organisations such as the Design Council and ICOGRADA, or RMIT Design Archives (RDA) in Australia, all of which are committed to the completion of projects, exhibitions, and doctoral research in design.

2 Methodologies

It is important to begin by introducing the methodologies that precede the ones conducted specifically for this study, considering the relevance of the previously collected data within a research project.

In the framework of Wisdom Transfer data was collected mainly through ethnographic interviews [11] carried out by the project researchers under the use of an interview script with open-ended questions [12]. Foreign experiences, international

relations, learning and personal experiences as students and/or lecturers, social and political awareness, were some of the questions addressed in the interviews.

These testimonies focused on a period of two decades, gathering a selected group of Art and Design professionals who attended the School of Fine Arts of Porto (ESBAP) between 1960 and 1980, a period of political turmoil in Portugal, and were mostly of biographical nature. Most of the selected interviewees represented an important, and sometimes a leading, role in the history of ESBAP.

Forty-two interview sessions were held during a period of one year (2018–2019), predominantly at the homes and studios of the interviewees, allowing for a direct and indirect ethnographic observation of displayed memories, daily habits and workplaces. These sessions were video recorded, single audio recorded and photographed. Besides the importance of recording data to assist research, it also allowed for the creation of a fund of resources [13], crucial to dissemination. This fund would feed a future design archive, enabling the inscription, perpetuating the local history of Art and Design, and relating data directly to the younger generations of designers and future designers.

Ethical considerations in this research project guided both research design and practices. These principles include voluntary participation, informed consent, anonymity, confidentiality and dissemination of results [14].

Subsequently, the transcriptions of the interviews, the notes from direct and indirect observations and the university records were cross-referenced. The following analysis conducted by the team researchers allowed for the recovery of a set of curricular practices in Art and Design under this period [15], analyse the circumstances behind the birth of higher education design in Portugal [16] and provided us crucial information for the workshops conducted within several design courses from several universities aiming to find the most effective and direct approach to insert scientific research outcomes into design curricula.

2.1   Outcomes Dissemination Under a Curricular Context

Several dissemination approaches were conducted, simultaneously, during the two-year period of the Wisdom Transfer Project, with the purpose of studying the most efficient way of not only presenting and communicating but also inscribing the research findings. A set of seminars, exhibitions, lectures, and workshops were conducted with the assistance of both researchers, lecturers, and corresponding design departments. All these events were filmed and photographed, and all the outputs documented.

The seminars and the exhibitions were open to the public, evolving not only researchers, faculty, and students but also the entire community, allowing for a wider range of communication. The five seminars conducted, gathered a group of three of the interviewees, moderated by a related theme guest, offering an informal talk about their life, their pedagogical and artistic experiences, shared between the panel of interviewees, in time and space.

Fig. 1 Preparatory meeting between FBAUP students and Wisdom Transfer research team ID+ @PINC—UPTEC

Although sometimes difficult to guide the group conversation, due to the enthusiasm and eloquence of our guests, we found that the collective model of interviewing triggered a set of memories that complemented data retrieved from the previous and individual interviews.

The seminars, the exhibitions and the lectures conducted in academic context, were welcomed and appreciated by the corresponding community and the public, however, although the impact was intense, it was brief.

Three workshops were conducted, under an extra-curricular model, at the Faculty of Fine Arts—University of Porto (FBAUP), School of Design—Polytechnic Institute of Cávado and Ave (IPCA), Barcelos and Lusófona University, Porto (ULP). All workshops followed a visual representation approach to address exploring new visual and narrative repertoires. The students were challenged to develop a critical and personal understanding of what this collected testimonies represent both to the inherence of knowledge and intellectual asset (see Fig. 1).

All workshops were available for design students at their corresponding university. Commitment was the main requirement. Inspired by our interviewees' testimonies, collaborative work was promoted to create a studio environment thus fostering the exchange of ideas. The extra-curricular model allowed bringing together a multidisciplinary group with different profiles and backgrounds. The fact that this model was optional and with no curricular evaluation, allowed for a more informal and motivated atmosphere.

The first one, held at FBAUP, was entitled "The narrative possibilities of illustration in trans-generational dialogue". This workshop intends, through illustration practice and the creation of illustrated narratives, the implementation of effective and affective engagement strategies between students and former Art and Design lecturers and researchers, already retired, through the creation of illustrated and visual essays. The proximity between generations finds a territory of dialogue and empathy through the practice of illustration, since it offers various narrative possibilities of representation of both the real and symbolic world, that when guided by the partial and particular perspectives of the universe of each of the interviewees and

Fig. 2 Illustration by Joana Coelho for the artist Puri Fontes. Workshop "The narrative possibilities of illustration in trans-generational dialogue" FBAUP 2019

students, finds its creative, communicative, and social, differentiating potential. Each stage of this project included 16 students from FBAUP, attending the degree course in Communication Design and the specialization course in Illustration.

This workshop was divided in two different moments. The first one was "The illustrated portrait". The portrait is chosen for its historical nature in the visual representation of a person's identity. The fact that it is illustrated allows each student to explore aspects such as honouring, making public or valuing a set of scientific, pedagogical and artistic experiences of former lecturers and researchers, considering that the participants are mostly unaware of those portrayed. (see Fig. 2) The retired lecturers and researchers are assigned to each student and the collected corresponding information is made available (biography, video interview, images, among others).

After a period of research and individual acknowledgement, by each student, of the universe and particularities of each interviewee, there is a first gathering of the physical and non-visible elements considered to be defining of the interviewee. (see Fig. 3).

The second moment was called "Illustrated visual essays/narratives". Setting out from the graphic/artistic, biographical archives or the interviews conducted within the scope of the project, each student performed several illustrated narrative essays. The aim was to explore new visual repertoires that provide a younger critical look on the heritage of knowledge and intellectual value offered by this past generation, through narratives that essentially rely on visual signs. Each participant developed visual narratives that result from the individual analysis, translation, and interpretation of the information provided from each interviewee's archive. The illustrated artefacts, produced by each student, are based on the narrative possibilities of this archive, composed by the interviewee´s knowledge and experience in an academic context, the work developed outside the academy, and any other stories revealed during research. (see Fig. 4).

Fig. 3 Workshop "The narrative possibilities of illustration in trans-generational dialogue" conducted by Rui Vitorino Santos at FBAUP 2019

Fig. 4 Workshop "The narrative possibilities of illustration in trans-generational dialogue" conducted by Rui Vitorino Santos at FBAUP. Risograph printing from the "Illustrated visual essays/narratives" 2020

The second workshop, held at ULP in 2019, was entitled "Typographical essays as a contribution to the transfer of transgenerational knowledge". Conducted by Cláudia Lima and Eliana Penedos-Santiago (both lecturers and project researchers), proposes the creation of a visual narrative, with a strong typographic component, based on the reading and interpretation of the testimonies provided by the project. The typographic/calligraphic poster was intended to visually represent a specific quote from one of the interviewed artists as a means of identifying its author, for the creation of a visual narrative. (see Fig. 4) The reduction of the narrated story to a quote, or a set of quotes, was a task assigned to the student leading the participants to a deeper knowledge of these Portuguese artists and designers life and careers (Fig. 5).

The last workshop, held at IPCA and conducted by Nuno Duarte Martins and Pedro Amado (both lecturers and project researchers), was entitled "Procedural pattern interpretations of the work of António Quadros Ferreira".

The workshop was conducted with a sample of voluntary student participants from the Graphic Design degree at the School of Design of the Polytechnic Institute of Cávado and Ave (IPCA), in four two-hour weekly sessions by the end of 2019.

Fig. 5 Poster by Bruna Pires on the artist Isabel Cabral. Workshop "Typographical essays as a contribution to the transfer of transgenerational knowledge", ULP 2019

The aims of the workshop were two-fold. On one hand, within the scope of the research project, it aimed to introduce and discuss the visual heritage of the work of António Quadros Ferreira (AQF). On the other hand, to introduce students to the fundamental concepts of functional programming for Graphic Design, with the Processing language.

During the sessions, the students revealed a total unfamiliarity with the work of AQF. A workshop that addressed both these issues was designed. The workshop was organized into four sessions, held during an extra-curricular period, for all interested students who voluntarily signed up. In the first session, participants were introduced to a specific set of AQF's work from the early 1970s. Having presented and discussed the algorithmic origin and computational process of the creators' work, participants were introduced to the programming language in the second session. In the third session, students started translating a personal interpretation of the AQF's language in their visual algorithmic process in Processing to design a book cover of their choice. The fourth and final session was held to supervise the work in progress and to help solve the technical issues and debug the code for them to be able to tweak and fine-tune and submit their designs autonomously in the following two weeks. (see Fig. 6).
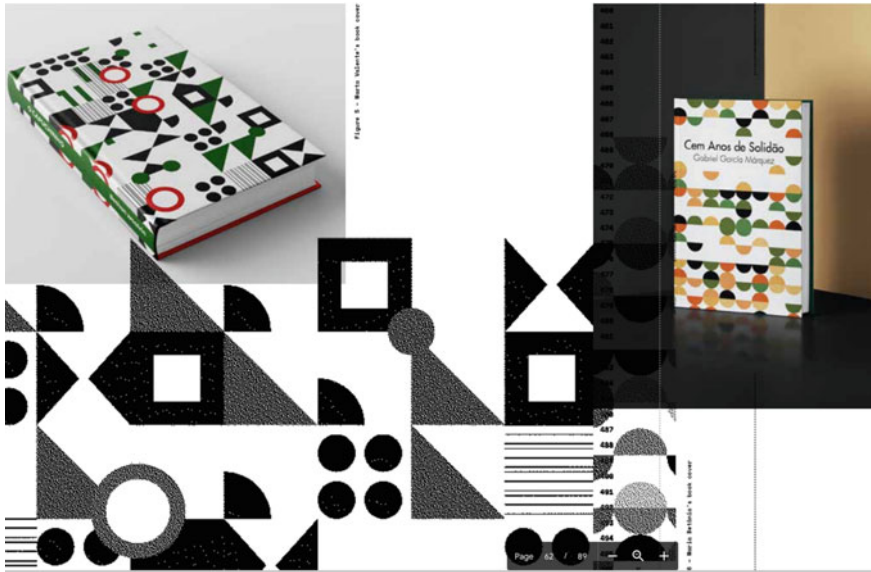
Fig. 6 Book cover by Marta Valente. Workshop "Procedural pattern interpretations of the work of António Quadros Ferreira"

Carrying out these workshops, as a way of creating knowledge and empathy between generations, within the academic institutions, confirmed the relevance and urgency of retaining and using, in the universe of higher education, the scientific, pedagogical, artistic, and human capital of its teaching and research community. Labelling is only the first action to valorise this heritage [17].

The outputs from these sessions were diverse. This methodological process allowed for all participants, lecturers, researchers, students, and corresponding institutions, to gain in-depth knowledge about this particular design research project findings. Empathy, free-will personal commitment, and engagement between the players were crucial to the success of this experiment. As a result, we gathered a set of visual narratives in the form of drawing, visual narratives, typographic essay, and algorithmic representation.

These initiatives and the corresponding outputs were presented in a final exhibition entitled "Threads of a Legacy" that took place on May 13th 2021 in the Casa Comum, University of Porto. The engagement between the students and the project outcomes, through the workshops, was immediately recognised by researchers and participants once compared to the other dissemination events, such as seminars, exhibitions, and lectures. Once this program ended, we started a detailed analysis of the aforementioned initiatives, namely the workshops. Some informal interviews and subsequent focus group sessions were held with lecturers, researchers, and students. According to all participants the workshops were the most efficient model of dissemination and

more importantly of curricular integration. The involvement, commitment and motivation implied in this initiative is determinant to achieve effective communication and perpetuate knowledge once compared to more passive dissemination models such as seminars, lectures, or exhibitions. This allowed us to outline a preliminary, integrated, and short-term curricular model, to be future tested and compared to the extra-curricular one.

An open access digital archive will also be considered as a crucial and expanding component of this dissemination study and thus enhance the reach and broadcasting capacity of research, involving students towards the mapping of Portuguese Design: influences, purposes and inspirations.

3 Integrated Modules Guidelines

One of the most significant factors for the success of these initiatives will imply the direct and indirect involvement of students and lecturers with active and ongoing scientific research projects, duly articulated and adapted to the year and curricular unit concerned, a task for which the contribution of the corresponding lecturers will be of the utmost importance.

These are some of the procedures that can be considered when translating design research findings into a curricular model:

- Collecting information from previous projects, unpublished interviews, and related data yet to be collected, combining ethnographic methods and interviews carried out in places with which our protagonists can establish ties of familiarity. This methodology will allow us to study our players based on qualitative methods (detailed observations, unstructured or semi-structured interviews and document analysis) [18].
- (i) Analyse content in context, (ii) organise and (iii) catalogue. Combine content analysis methods by cross-referencing existing records and new material to be collected with future expansion of research on the topic. Additionally include affinity diagrams, an inductive method in which qualitative research data is relationally separated and organised, combining observations and interpretations from research without ever neglecting data [18].
- Ongoing interviews with archivists and curators from different institutions, with particular focus on the area of Design, to understand the multiple possibilities of an online digital catalogue, such as the use of sources, a look at history, design processes or documentation of one's practices.
- Conduct a series of usability tests supported by iterative evaluation research methods [18].

3.1   Proposal for a Build-In Module on Design Research

These short built-in modules aim at a continuous input of scientific research results within the pedagogical structure of an Art and Design course. They have a multi-disciplinary adaptability nature to the hosting curricular units and aim, beyond the scientific inscription, within the curricular plan, to collect the educational results, disseminate them and reintegrate them into scientific research.

Duration. According to the experiences previously conducted, the average time necessary for its implementation will be 12 h of contact, time that can be adapted according to the time allocated to each curricular unit. The average time expected for the autonomous work will be 18 h.

Learning outcomes—knowledge, skills and competences to be acquired by students. (i) Establish a direct relationship with the Portuguese Design history concerning its origins, influences, purposes and inspirations, going through not only the published materials, but also integrating the invisible experiences and stories through the active participation of design research and researchers in the teaching–learning process. (ii) Explore new visual repertoires that offer a critical and fresher look over the inheritance of knowledge that essentially rely on visual representation. (iii) Explore an imagery discourse adequate to the needs of visual communication. (iv) Contribute to map the Portuguese Design: influences, purposes and inspirations, in a time of cancel-culture.

Curricular content. The curricular contents of this integrated curricular module seek the consolidation of an active historical heritage through its curricular reactivation in Art and Design, by means of an integrated modular learning environment. This particular module employs an inclusive method intended to relate the current generation of designers with Portuguese Design, through education.

The proposals will address the main areas covered by the course in Communication Design, such as: multimedia, new media and digital cultures, editorial design and typography; illustration; photography and audio-visual studies and practices; history and critics of design or visual culture studies. The research projects, already finished and ongoing, within ID+, the Research Institute in Design, Media and Culture, will contribute as catalysts for these initiatives.

The module will be organised under the form of four fundamental sessions, organised in accordance with the hourly distribution of each hosting unit:

- Establish access to the collected material from completed and ongoing Design research projects and the research team involved.
- Explore the scope under the hosting unit's contents and tools as a visual representation of exchange, cross-learning, identity, heritage and intergenerational dialogue.
- Interpret/translate life stories through visual representation determined by the curricular nature of the welcoming unit. This session includes the completion of the final project which may be carried out individually or in groups.

- Assert the legacy and knowledge of past generations as an active archive of utmost importance, to current and future generations, through the production and subsequent integration of the final projects into the online digital catalogue.

Learning Methodologies. The proposed teaching methodologies aim at the contextual and transversal analysis of previously collected, and still to be collected, data under the scope of scientific research projects in Design. Conceptual mapping offers the necessary support to data compilation and visualisation, establishing and breaking connections with several milestones in Portuguese Design history, promoting its expansion beyond the current guidelines, to its dissemination and inscription. The curricular framework for the integration of scientific research in Design will allow the pedagogical model to become a part of the scientific model.

Each module combines the following methodologies during the lecture time in the classroom:

- Historical and conceptual presentation and discussion of relevant references.
- Presentation of the research carried out by the research team: material collected and findings available. The collected material can be characterised by a set of interviews in audio-visual support and transcribed in text documents, audio recordings, existing records provided by the university, etc.
- Whenever possible the interviewees directly involved in the research project, will be invited to attend one of the sessions to provide a greater proximity to the sources of information.
- Resource and coordination of the research topic with the available tools at the welcoming unit.
- Accompanied elaboration of individual or group practical activities.
- Carry out a final project.
- Presentation and discussion of results.
- Dissemination of the outcomes by means of their publication in the online digital catalogue, thus effecting the relationship between generations towards fostering empathy, the sense of belonging and promoting an active dialogue between scientific research and the pedagogical agenda. The relationship with the community, equally important, can be established through exhibitions and publications.

4   Discussion and Future Research

The results obtained from the workshops conducted during the first stage of the project revealed that these models of scientific dissemination, through the integration of the research findings in higher education activities, providing a closer articulation between scientific research and the pedagogical framework.

Given the significant number of researchers teaching in higher education, these short-term models with immediate application aim at being replicated in other research domains of Human and Social Sciences. These models allow for a closer

relationship between the teacher/researcher and the students, blending different knowledge domains within the educational institutions.

On the other hand, they provide a framework for the creation of new solutions for dissemination, inscription and reactivation of knowledge, often in the form of personal memories and experiences, within a curricular environment.

And the fact that they are designed with the ability to blend in, in a flexible and adjustable way to each running curricular unit, enables the preservation of the curricular structure and avoids bureaucratic constraints that often compromise the relationship between information and time. These are models of participatory design that simultaneously disseminate and study, under the form of applied research, scientific-pedagogical methods and approaches.

The next step will be to put these modules into practice and carry out a set of surveys addressed to students, lecturers, and researchers. These questionnaires should inform the researchers about the depth of the relationship established between the students and the information, apprehension rates and the capacity to represent a critical look on the research topic through a visual narrative.

It also will be very important to understand the lecturers' vision on the method once compared with the ongoing methodologies refined over time for teaching models of semester and annual nature, feeding into the current debate of "open pedagogy" in the classroom. Lastly, it is important for researchers to understand how this pedagogical input can feed back into scientific research, creating links and establishing an intellectual proximity that can benefit and enhance scientific dissemination. After analysing and comparing the results obtained from the extracurricular experiences previously performed, the focus groups should be repeated in order to improve and adapt the pedagogical model to the different research streams in Art and Design.

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Designing for People with Dementia in Academic Contexts

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Abstract   This article reports a pedagogical project carried out in collaboration with Memória de Mim Day Care Centre (a service by Alzheimer Portugal) within the course of Design Lab of the Communication Design BA, at the University Lusófona, Porto. This project aimed to highlight, explore, and articulate methodologies and tools of Design for social issues, through the development of works oriented to People with Dementia at an early stage. These works included mainly signage materials and cognitive stimulation materials. Concurrently, this project contributed to the professional integration of students by acting as designers in a real context. This article reviews the methodological approach used, namely a set of adaptations required due to Covid constraints and their impact on the work process, and the outcomes are analyzed and discussed foreseeing to improve the project dynamics. It is expected the continuity of the project in the next academic years and a possible replication of the model of these pedagogical practices in other university contexts for an approach to Design more oriented to human needs that may contribute to the training of Designers aware of the importance of their role as social agents.

Keywords Alzheimer Portugal · Design for People with Dementia · Pedagogical practices · Social design · Cognitive stimulation materials

1   Introduction

Between 2018 and 2021, design projects for social institutions were developed within the scope of the Design Lab curricular unit, a subject taught in the first semester of the 3rd year of the Communication Design BA at University Lusófona, Porto (ULP), Portugal. These projects aimed to develop students' skills in Social Design, an area

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distinct from that oriented to the market, to which most of the contents of the Design courses are devoted. In line with Margolin's view, the practice of Social Design is distinct from the concept of Design coming from the product market context by defining it as "that exercised for the satisfaction of specific human needs" [1]. This differentiation is based on the assumption that Design was born in a market context which does not contemplate the whole spectrum of social needs, since many of these needs are related to groups of individuals who are not part of the consumer public—such as low-income individuals or individuals with special needs arising from age, health problems or disability—and therefore do not bring profit to companies. Furthermore, Margolin underlines the importance of the practice of Social Design being integrated into curricula, considering that Design educators can assume a fundamental role as collective agents of change [1].

On the other hand, as Design Lab is a subject of the 3rd year—last year of the course—these practices also envisaged the integration of students in the workforce by developing project proposals for real clients. In other words, these are projects that propose a reflection on the role of Design as a social agent through research, practice and the production of visual communication materials that aim to respond to real specific needs in society.

These pedagogical practices were anchored on three axes:

(1) The need to integrate students in the professional activity, through the development of projects that aim to respond to real societal needs;
(2) The difficulty for social institutions to harness the potential of Design tools and methodologies to respond to the needs, either of the institution or the community where they are located, due to the lack of human and financial resources;
(3) The inexistence of a curricular unit structured in the scope of Social Design in the Communication Design BA (which, indeed, analyzing the 2020–21 curricular programs, is verified in the several Communication Design courses proposed by the Portuguese universities).

In this sense, it was structured a program for the curricular unit of Design Lab based on the following objectives:

- To highlight the importance of social innovation as a fundamental field of application for the area of design.
- To promote a socially aware design practice, aimed at responding to human needs.
- To identify ways in which Communication Design can contribute to meet specific human needs through projects for real contexts.
- To educate attentive, participatory, and responsible designers regarding the planet's sustainability and human needs.
- To explore and articulate methodologies and tools of Communication Design for social issues.

The projects were based on partnerships with local social institutions such as Portuguese Red Cross—through its Delegations in Matosinhos and Vila Nova de Gaia—or Eu Sou Eu—Associação para a Inclusão Social de Crianças e Jovens

(Association for the Social Inclusion of Children and Young People), and aimed, through Communication Design, to contribute to solutions for a set of problems and needs identified by the institutions themselves. Among the main issues reported was the need for greater visibility of the institutions involved, their mission and actions in the social fabric; the lack of financial means and human resources to respond to the social needs that emerge every day; the lack of specialized human resources to implement effective communication strategies. Hence, the proposals developed by students were primarily aimed at creating corporate identities, campaigns to raise awareness of the social role and actions developed by the institutions, promotional materials for the services and activities provided to the community, and campaigns focused on possible ways of community support through volunteering, donations, and membership [2]. At the beginning of each academic year a common proposal was made for all students to be worked on during the period of one semester and, at the end, the best proposal was selected to be used by the institution. In these cases, the number of selected proposals was always limited, since all students worked to a common and objective brief regarding the intended materials.

In the 2021–2022 academic year, a different approach was taken, seeking to direct the Communication Design practices towards the needs of a specific community, and not exclusively towards the institution that serves that community, unlike what had been done in previous years.[1] This change in the approach was due to the nature of the institution with whom a partnership was established, the Alzheimer Portugal Association—specifically the Memória de Mim Day Care Centre which is managed by the North Delegation of this Association—and the brief issued to students. The approach to the project was also revised (in relation to previous years) following the constraints resulting from the Covid-19 pandemic.

This paper reviews the methodologies and strategies adopted for this project as well as the outputs, aiming at possible replication of the model of these pedagogical practices in other teaching contexts. An approach to Design more oriented towards social causes and within the principles of sustainability is envisaged, contributing to the training of Designers aware of the importance of their role as social agents.

2   Alzheimer Portugal

According to data published in the *Dementia in Europe Yearbook* [3], in 2018, dementia cases in Portugal exceeded 193,000 (corresponding to 1.88% of the population). The prevalence of this disease is a growing social problem. Age is one of the biggest risk factors for dementia [4]. Given the increasing ageing of the population, even though the number of inhabitants in Portugal is decreasing, it is estimated that, in 2050, the percentage "of People with Dementia will more than double": the

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[1] It is considered that the community has always benefited from the projects carried out, but in an indirect way, since the briefings pointed out the needs of the partner institutions such as Red Cross or Eu Sou Eu, and not of the community to which they provide services [2].

number of individuals with dementia may exceed 340,000, which, in percentage terms, corresponds to 3.46% of the Portuguese population [3].

Moreover, the study *Health at a Glance 2021: OECD Indicators* [4], places Portugal as the 4th OECD country with the highest prevalence of dementia, with more than 20 cases per 1000 inhabitants. Although there are few Portuguese studies on dementia in the country [5], it is estimated that, despite the various manifestations of dementia, the percentage of individuals with Alzheimer's disease is between 50 and 70% [6].

The most common symptoms experienced by People with Dementia may include memory loss; difficulty performing familiar tasks; problems with language; disorientation in time and place; poor or decreased judgement; problems with concentration, planning or organizing; misplacing things; changes in mood or behavior; trouble with images or spatial relationships; withdrawal from work or social activities [7]. Non-pharmacological treatments have proven to be essential to reduce these symptoms, namely Cognitive Stimulation Therapies: studies show that they are effective in improving cognitive function and quality of life with positive results among people with mild to moderate dementia [8, 9]. Accordingly, researchers and therapists have advocated for activities in this area that are focused on people and their individuality, adapting materials to the culture and family aspects of People with Dementia [10].

Alzheimer Portugal is a Private Institution of Social Solidarity founded in 1988 "which aims to improve the quality of life of People with Dementia and their Caregivers" [11]. As a non-profit organization, the Association seeks its sustainability in several ways to meet its objectives, namely through partnerships, volunteering, donations, among others. It emerged in order to inform and support this public and, in the words of Maria do Rosário Reis (member of the Alzheimer Portugal Board of Directors), it has grown "filling gaps that neither the public authorities nor the private sector knew how to or wanted to fill". Reis adds that the work of the Association and what it represents "emerged from the awareness that People with Dementia and their Caregivers needed specific services and responses, which still do not exist today in much of the territory in an integrated and accessible way" [11].

Among the various types of support and information that they offer to People with Dementia and their Caregivers, they provide a network of specialized support offices and day care centers, one of which is the Memória de Mim Day Care Centre. This Centre has been operating since 2016, in Matosinhos (a city next to Porto), and is managed by the North Delegation of the Association. It is a specialized Centre for people with Alzheimer's disease and other types of dementias in the early stage, which provides a set of "therapeutic activities, with the aim of stimulating the remaining cognitive, psychomotor and sensory skills" [12]. Among the diverse individual and group activities, the following can be highlighted: Playful and Expressive Activities, Reality Orientation Therapy, Cognitive Stimulation, and Multisensory Stimulation.

The project developed for Memória de Mim Day Care Centre was based on the dynamics and issues related to these activities. Although it was grounded on the same premises of previous projects (carried out for Portuguese Red Cross or Eu Sou Eu), it was not targeted at the needs of the institution itself (its visibility, mission and

actions, or the need to raise volunteers or fundraising), but at the needs of its users (People with Dementia at an early stage) in their daily lives at the Centre.

3 Methodological Approach

For the development of the project, a methodology already tested in previous projects for Portuguese Red Cross and Eu Sou Eu was adopted. Hence, Design Thinking methods were used [13, 14] "as the basis of a work process divided into three essential phases: problem definition; project ideation; project implementation" [2]. However, certain aspects of this methodology had to be reviewed and reformulated following the constraints resulting from the Covid-19 pandemic, particularly those that required personal contact with the Day Care Centre users and collaborators.

In September 2021, an online presentation of Alzheimer Portugal and, in particular, of Memória de Mim Day Care Centre was made by the Technical Director of this institution. Issues related to the symptoms of dementia, namely those most prevalent in the Centre's users, were also addressed. Following this, two proposals were presented to the students, within which they could define a specific project to develop:

(1) The study of signage for the Day Care Centre;
(2) The study of cognitive stimulation materials based on Portuguese culture.

In the first case, particularities of dementia were highlighted, such as frequent memory loss, disorientation in time and space and, in certain cases, vision loss. Accordingly, several work possibilities were suggested, such as the identification of the Centre's spaces; the identification of routes to follow between spaces as a response to possible disorientation of the user; or the creation of decorative images as an identity reinforcement of the spaces or as a means to aid temporal orientation.

As for the second proposal, one of the requirements highlighted was that the cognitive stimulus materials should be focused on Portuguese culture since the materials currently available in this field are scarce, expensive and do not reflect Portuguese culture or traditions familiar to the Portuguese population. This was, in fact, one of the main streams since many of the activities they carry out are focused on memory stimulation exercises, hence, based on experiences and things familiar to the Centre's users, which are intrinsically associated with local culture and spaces.

The following sessions were dedicated to the definition of the problem. As the topic of dementia was very little known by the students, a seminar was organized with the presence of Rita Maldonado, researcher at ID+ (Research Institute for Design Media and Culture, University of Aveiro) specialized in design for dementia, who presented her PhD project *Codesingning communication in dementia* [15] and brought several practical examples of design objects developed for this audience (Fig. 1).

This presentation was followed by a period in which students researched for the project autonomously, mostly resorting to existing documentation, interviews with
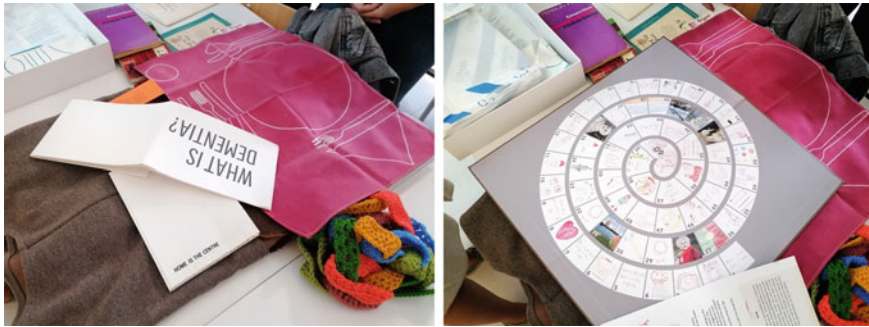
Fig. 1 Materials developed with and for People with Dementia by Rita Maldonado during her Master and PhD project. Materials presented at the seminar held on 27 September 2021 at ULP

professionals working with People with Dementia and visual research of current materials.

In previous years, at this stage of problem definition we used to organize a study visit to the partner institution. In the impossibility of such visit, given the restrictions caused by the pandemic, students were allowed to make occasional visits, in small groups, at a later stage (between November and December).

After the problem definition, students decided if they wanted to develop the project individually or in groups and started the ideation phase. Several ideas and approaches to the project were outlined and discussed, the accessibility and usability of the project was assessed regarding the particularities of the target audience, as well as its material and financial viability.

This ideation phase took place between October and December, during which 3 interim presentations of the project were made corresponding to different stages of development: (1) conclusions of the research work resulting from the problem definition and possible ways of approaching the project; (2) presentation of design proposals under development, analysis of its suitability to the target audience and material and financial viability; (3) presentation of project prototypes for analysis and discussion of aspects such as functionality, accessibility and usability. These interim presentations were an opportunity for individual self-reflection on the projects, analysis, and discussion of results in group, and study of forms of presentation/communication of the proposals, a relevant point, considering that, in a final stage, students had to make an oral presentation of their project to the client.

As aforementioned, between November and December, the students made visits to the Day Care Centre in small groups. These visits allowed them to know the facilities (until then they only knew them through photographs) and to present prototypes of the projects under development to the Centre's Technical Director, providing a moment of reflection, analysis and discussion about the proposals, identification of weaknesses and opportunities.

At this stage, a session was also held with the researcher Rita Maldonado, who made an individualized assessment of the projects, also identifying aspects which

were less well addressed or even unsuitable for the target audience and proposing possible ways of overcoming them.

In January, the projects were concluded and presented to the Technical Director of Memória de Mim Day Care Centre and are currently available for use by the users of the institution.

4 Projects for Memória de Mim Day Care Centre

While previous projects carried out within Design Lab course were targeted to the partner institutions' needs [2], this project for Memória de Mim Day Care Centre was targeted to the needs of a specific population, People with mild Dementia. As mentioned by Maldonado, dementia severely affects the patients' autonomy in their most diverse daily activities, so "dementia care inevitably focuses on the daily necessities, such as feeding and hygiene, often leaving little space and energy for finding ways to communicate in alternative and meaningful ways" [15]. In this sense, there is an urgent need for professionals, including Communication Designers, to make the environment of these patients more functional and accessible, to assist in their daily routines and to create a set of supports for cognitive stimulation and to encourage socialization and communication.

This project for the Day Care Centre, introduced the students to a concrete reality, by identifying specific needs directly related to the daily life of its users and suggesting that the contributions fall within two possibilities—the study of signage for the Centre and the study of cognitive stimulation materials.

For the first proposal, one of the students chose to develop a system to identify the Centre's spaces. This project was complemented by the project of another student who developed a set of thematic illustrations to be seasonally framed in the dining room. These illustrations aim, on one hand, to reinforce the identification of the Centre's spaces and, on the other hand, they act as a cognitive stimulus by alluding to the different seasons of the year, i.e., they contribute to orientation in space and time.

Another signage project consisted of an identification system for the users' lockers based on sets of images related to themes such as professional activities, football club, places in Portugal, cuisine, among others. These images were created based on the answers to a survey made by the students to the Centre's Technical Director about the users, addressing topics such as where they were born or where they live, favorite hobbies, professional activity, and other aspects of their personal experiences. The images created are made available to users who can choose the ones with which they most identify and, thereby, personalize the doors of their lockers, reinforcing the identification system. This project, when put into practice with the help of the Centre's therapists, may also provide moments for sharing experiences and memories (stories about professional activity, places where they were born/ lived, favorite foods…), acting as a cognitive stimulus.

Fig. 2 Goose Game by Anabela Thomé and Diana Cruz, 2022

For the second proposal, study of cognitive stimulus materials, students focused essentially on playful activities assuming that the use of these materials would be done through the mediation of a therapist or an assistant from the Memória de Mim Day Care Centre.

Two students developed an adapted version of the Goose Game (in Portugal known as Jogo da Glória) based on Portuguese popular culture with the purpose of stimulating the users' cognitive memory and encourage moments of socialization and conviviality (Fig. 2). Different themes were addressed in the game, such as Food (typical Portuguese dishes, foods that the users most/least like), Experiences (memories of holidays or journeys made, stories from school or work), Music (questions about popular Portuguese songs, songs that have marked the player's experiences and, occasionally, encouragement to sing well-known songs) and Popular Sayings (a challenge to complete popular Portuguese sayings). These themes and the way the challenges are presented within each of them, aim to provide moments of leisure, dialogue, sharing and conviviality, while simultaneously act as a memory stimulus for each person. In other words, they aim to contribute to ameliorate the symptoms of memory loss and social distancing.

Two other students developed a coloring book that appeals to the five senses to invoke memories of the past. The illustrations in this book are focused on iconic sites and monuments of the places where the Centre's users live(d) or were born, sites and monuments of reference for them, such as the Douro Vineyards, the Matosinhos beach, the Castelo do Queijo (Fort of São Francisco do Queijo), the Serralves Museum or the Crystal Palace. This project proved to be a real challenge for these students since they are French and were doing this course under the Erasmus Mobility for Students. As they were foreign students, in-depth research on Portuguese cultural and local aspects was required, along with research on the topic of dementia.

Next to the illustrations designed for the book, a space was created where the user is invited to share a memory of the place depicted and associate a color, a sound, a smell, a taste and a texture, reinforcing, through the appeal to the senses, the cognitive stimulus (Fig. 3). Each illustration is associated with an audio file with sounds recorded at the place portrayed to be played at the moment the activity is put

Fig. 3 Coloring book by Anna Le Floch and Lara Guivarch, 2022

into practice. The aim is to encourage the user's immersion in the place depicted and stimulate, through the sounds, the memory of stories experienced in each place.

One student developed puzzles with illustrations of iconic places of the city of Porto, also associated with the experiences of the Centre's users, such as Torre dos Clérigos or Ponte D. Luis. These illustrations are presented in outline, inviting the user to color them and, thus, to personalize his/her puzzle. Three different versions were developed—with 6, 12 and 18 pieces—allowing the degree of difficulty of the playful activity to be adjusted to the abilities of each person.

Within the scope of cognitive stimulation materials, a Bingo game adapted for People with Dementia was also developed. To this end, changes were made to the rules, to the format and to the very way of playing the game, aiming at a greater suitability to the audience in question. The characteristic numbers of this game were replaced by illustrations inspired by iconic elements of Portuguese culture, divided into 4 categories: heritage, festivities, seasons, and professions. Two versions of the boards were made, one with a set of 4 illustrations and the other with 8 illustrations, to provide two levels of difficulty that may better meet the individual abilities of each user. The cards designed for this game also have the potential to be reused in a memory game through the association between the card with the illustrated figure and the card with the corresponding silhouette, thus expanding the potential use of this game (Fig. 4).

5 Discussion

The comprehensiveness of the work proposal and the fact that all projects could be used by the Memória de Mim Day Care Centre clearly acted as a motivating factor and fostered greater interest and commitment from students. In fact, there were several aspects that contributed to the motivation, sense of commitment and engagement in this project, namely: the possibility for students, as designers, to act in different areas, according to perceived needs and their particular interests in certain fields of Design; the possibility of all projects being adopted and used by the Centre, reducing
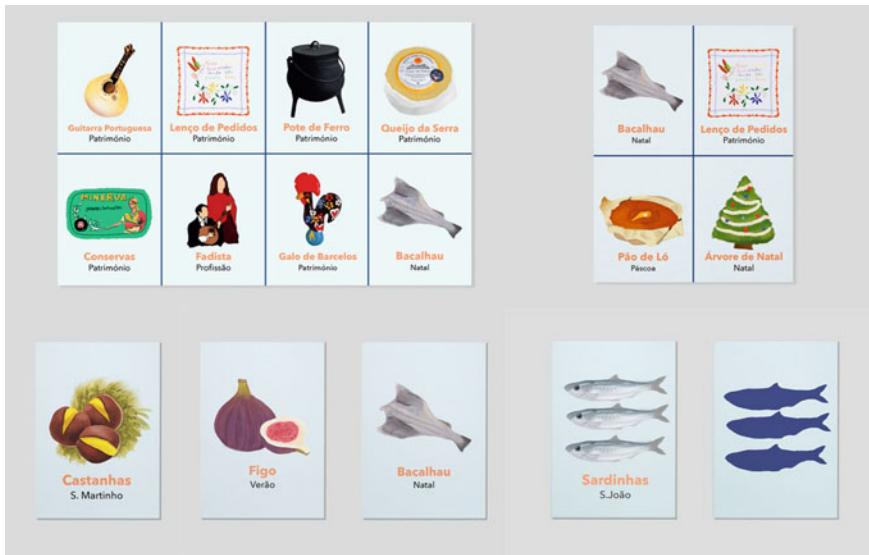
Fig. 4 Bingo game by Mafalda Marinho, 2022

an eventual competition among peers and, consequently, increasing the sharing of knowledge, opinions and mutual learning; the direct contact with professionals in the area, namely, the Centre's Technical Director and the researcher Rita Maldonado, who shared their knowledge and personal experiences with People with Dementia. Furthermore, the fact that it was a project for a real client that aims to meet specific needs of a public often neglected in the field of Design in Portugal, also triggered, and increased the sense of commitment of students.

Indeed, the work carried out reveals a clear interest by the students in contributing to solutions to improve the environment and well-being of the users of the Memória de Mim Day Care Centre. It is evident the respect and consideration for the target audience, and the desire to deepen the knowledge about the particularities of dementia—until then unknown to many—through research carried out either in groups (in class context) or individually, through interviews that they conducted autonomously to professionals with experience in this area and subsequent contacts with the Technical Director of the Centre. In this regard, the presentation made by the researcher Rita Maldonado was also important, not only for the contextualization about dementia and its forms of manifestation but also for the shared experiences of the long periods that she lived and worked with and for People with Dementia and for the examples of design work carried out in this scope, practical and diverse examples that broadened the students' horizons about countless possibilities of intervention.

One of the projects shown by Maldonado consisted of a set of "empathy exercises" through the manipulation of texts in books. Throughout each book presented, the text was gradually hidden (some through cut-outs, others covered with white ink), simulating the growing loss of memory. These projects allowed students to better

understand the evolution of one of the most common symptoms of dementia. It is worth noting that, in an analysis made after the conclusion of the students' projects,[2] Maldonado suggested carrying out exercises in this area in the classroom context, as they can help students put themselves in the place of someone with dementia, i.e., they allow a different perception of the disease, more experiential, and complementary to reading. It is recognized that, in a project of this nature, the ideal would be for students to have direct contact with the target audience, the People with Dementia, for a more in-depth knowledge of their characteristics and particularities. This contact was not possible due to the restrictions resulting from the pandemic. Although the country was no longer in lockdown, access to health institutions was still very limited, making this contact unfeasible. In this sense, the contact with professionals from the Centre, who work directly with these People with Dementia and have an extensive experience, was the possible way to approach and get to know the public under study.

The impossibility of making a field visit with the class to Centre at the beginning of the year, as it was initially planned in the syllabus, led students to make visits at a later stage and divided in small groups. Two advantages resulted from this adaptation to what was initially planned: on the one hand, when the students visited the Centre there was already a project concept and prototypes developed which could be shown and analyzed, resulting in a better adequacy of the projects to the Centre's users; on the other hand, the visits in small groups allowed a more individualized and personalized follow-up of the projects, by the Technical Director of the Centre. In other words, what seemed to be a constraint in the project turned out to be an added value in methodological terms.

Another important moment in the project methodology was the individual analysis and discussion of the projects by the researcher Rita Maldonado, in the middle of the semester. At this time, the concept of the projects was defined, and the design was at an advanced stage of development, allowing the expected results to be foreseen. Maldonado's assessment was essential, especially in the guidance on how to operationalize the materials, considering the particularities of People with Dementia. For example, in the Goose Game, it was very important to review the formulation of the game questions to ensure more interesting answers and greater sharing of experiences, a knowledge acquired through long periods of contact with People with Dementia and learning from health professionals. In this case, the students had the themes, but lacked the way to ask the question. In other projects, there was an expectation that users would respond to the activities in a certain way that might not actually be realistic given the characteristics of the target audience. In this regard, Maldonado's contribution was also essential, by guiding and adjusting the projects, improving their accessibility and usability.

At the end of the semester, the results were materialized in very different projects, all of them likely to be adopted and used by the Memória de Mim Day Care Centre. In fact, some of these materials, such as the Bingo game, have already been tested with

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[2] After concluding the projects, an interview was held with Rita Maldonado on 26 January 2022, for analysis and discussion of the project, methodologies adopted, and results obtained.

the users and the feedback obtained was very positive,[3] both as regards their potential as cognitive stimuli and as promoters of moments of conviviality and sociability, and concerning issues related to functionality, accessibility, and usability.

Although the cognitive stimulus materials were designed for the Centre, all of them (Goose game, coloring book, puzzles, and Bingo game) can be put into practice in other contexts, such as at home. Indeed, they were created having in mind that these activities will be mediated by therapists or assistants of the Centre, but this mediation may, however, be extended to family members or Caregivers. Nevertheless, and as highlighted by Maldonado (personal communication, 26 January 2022), it is recognized that the use of the materials at home may be affected by several constraints since there is a different dynamic that is more difficult to predict given the affective proximity with the patients, emotional issues and, sometimes, lack of in-depth knowledge of family members to the particular manifestations of dementia.

6   Conclusion

The project carried out for the Memória de Mim Day Care Centre allowed students to get acquainted with a less addressed area of Design—Social Design —, and to understand through practice possible contributions of Communication Design as a social agent. It was also a project that provided a real work context, promoting the professional integration of students who are in the final phase of their training in Design.

Certain adaptations made to the methodology of the project following the constraints caused by the pandemic proved to be, indeed, an added value. In particular, the way the visits to the Centre took place, at a later stage and in small groups of students—a change made to the structure and timing of the project that may be an aspect to be reconsidered in the future. One possible approach might be a visit at an early stage—to get to know the partner institution, its collaborators, and users—and a second visit at a stage when a project concept has already been developed and exemplary prototypes have been produced for analysis and discussion of the feasibility and suitability of the project.

By analyzing the results obtained in the projects carried out between 2018 and 2021, for Portuguese Red Cross and Eu Sou Eu, and the results of the project for the Memória de Mim Day Care Centre, a set of conclusions can be drawn: (i) the project's orientation towards the community (and not the institution) is a factor of increased motivation; (ii) a comprehensive proposal from which distinct projects may emerge, and might be applied, eliminates eventual competition between students and results in greater sharing of knowledge and collaboration between peers; (iii) the frequent interlocution with professionals and researchers in the area under study increases the sense of commitment and allows a more specialized knowledge, factors with a positive impact on the outcomes.

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[3] Marta Melo, personal communication, 7 February 2022.

Following the results of this project, the continuity of pedagogical practices in this field is now under study, still in partnership with Alzheimer Portugal but on a national scale, involving other fields of design (graphic, illustration, multimedia) and other university institutions.

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How Design and Technology Can Contribute to Learning: The Mobeybou in Brazil Educational Game Case Study

Rafael Fernandes, Cristina Sylla , Nuno Martins , and Maitê Gil

Abstract Currently, there is a generation of children that tend to be exposed from a very early age to digital media, especially in the most economically and culturally developed societies. Thus, it is necessary to think about ways in which technology can contribute to learning, namely by seeking to converge the recreational component with the educational while preventing or suppressing potential dangers. This study aimed at extending the Mobeybou pedagogical materials, i.e., a Digital Manipulative for storytelling, and a set of interactive story applications, thus integrating the easy access that children have to technologies and the positive characteristics of games. In this context, here we present a descriptive case study of the design process of the interface for a game to be integrated into the Mobeybou in Brazil story app. The game interface is intended to reinforce the knowledge conveyed through the reading of the story app, therefore contributing to the development of language skills, creativity, and digital literacy. The game interface should be easy and intuitive to use, its development followed a design thinking methodology. A pilot test carried out with a group of five children aged between 8 and 9 years-old revealed very encouraging results, showing that the game interface was easy to use and engaged children with the story content.

Keywords UX design · UI design · Design thinking · Mobile game · Mobeybou

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1 Introduction

Never before have young children been exposed to digital media as today [1, 2]. A study carried out by Common Sense Media in the United States [3], on the use of media by children up to 8 years of age, pointed out that children, between 5 and 8 years-old, spend an average of three hours a day in front of a screen. The two activities where they spend most of their time are watching television or videos (73%) and playing video games (16%).

Depending on how these digital technologies are used, they can be beneficial or detrimental for children [4]. Using age-appropriate and well-developed technologies has the potential to promote learning in a playful way [5]. On the other hand, there are also negative effects when children visualize inappropriate content [4]. Excessive use of smartphones or tablets may also pose a risk to children's health, such as visual problems and physical inactivity.

This work emerged in the scope of Mobeybou[1] (Moving Beyond Boundaries), a research project that consists in the study and development of a set of digital tools for the creation of narratives aiming at contributing to the development of cognitive, social, and linguistic skills in young children within a multicultural context [6]. It aims to take advantage of the easy access that children have to technology and the positive characteristics of games and playful technologies.

1.1 Project Background

The central tool of the Mobeybou materials is a Digital Manipulative (DM). DM are objects with embedded computational properties that serve as interfaces for manipulating digital content [7]. Mobeybou is composed of 60 physical blocks that communicate with a computer device via Bluetooth and with each other via magnets embedded on the sides. Each block represents a story element from different world cultures. Connecting the blocks triggers the embedded digital content such as static and animated images, ambient sounds, and music (see Fig. 1). The children create their stories by connecting the blocks to each other while they verbalize their stories. The stories can also be recorded. A digital version of the DM, the StoryMaker, allows using the digital environment without having the physical blocks.

Additionally, there is a set of interactive story apps (Mobeybou in India, Mobeybou in Brazil, and Mobeybou in Cape Verde) that give children information about the different cultures represented in the DM and the storyMaker. Here we will focus on the interactive story app Mobeybou in Brazil. Like all the Mobeybou story apps, Mobeybou in Brazil uses the cultural elements represented in the DM. The story starts in the south of Brazil and the protagonist travels through the different regions to the north, visiting different landscapes and overcoming several challenges along the way. To read the narrative, the child can choose between a boy and a girl protagonist. To

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[1] http://mobeybou.com.

Fig. 1 The Mobeybou DM (left), Home screen of the story app, Mobeybou in Brazil (right)

reinforce the knowledge acquired during the reading of the story app, we decided to develop and integrate into the app a game with its story elements. This paper reports the development of the game interface. In the following section, we will begin by presenting the theoretical framework and then a descriptive case study of the design process of the game interface.

1.2 Theoretical Framework

User Experience Design (UX) and User Interface Design (UI). To develop the game interface, it was necessary to consider the dimensions of the User Experience design (UX Design), User Interface design (UI Design) as well as the product usability. These are essential dimensions that need to be analyzed when creating digital products. UX Design is the process of creating an experience that meets the needs of the user when interacting with an interface [8]. The quality of the user experience is determined by the ease or the difficulties that the user experiences while interacting with the interface [9]. Morville [10] considers that for having a positive experience the product must be useful, usable, desirable, findable, accessible, credible, and valuable. Usability is directly linked to the user experience. Usability is referred as a quality that reveals the ease of use of an interface [11, 12]. Nielsen [13] refers to usability encompassing five components:

1. Learnability: how easy it is for the users to complete the tasks the first time they use the interface;
2. Efficiency: how quickly the users complete the tasks after knowing the interface;
3. Memorability: how easily the users regain usage proficiency after a period without using the interface;
4. Errors: number of errors that the users make and how easily they recover from them;
5. Satisfaction: level of satisfaction that the user has when using the interface.

Usability can be used as a product's quality that can be evaluated or as a set of principles that help achieve that quality. These are known as the ten usability heuristics, developed by Nielsen [14]. These usability heuristics are general rules

and not specific usability guidelines. A way to evaluate the usability of a product is through usability tests. The tests allow identifying design problems and opportunities [15]. According to Nielsen [16], a usability test conducted with five users allows detecting up to 85% of the usability problems of a product.

UI Design plays an important role in creating experiences, it consists of the design of the interface elements, e.g., buttons, menus, and other interactive elements that allow the interaction between a user and a device [17]. Here the designer must have graphic and digital design skills to adjust the visual properties of these elements, such as color, shape, typography, graphic composition, and hierarchy to create an interface that is both appealing and functional.

In short, UX Design and UI Design are complementary concepts that depend on each other to create relevant digital products. If one of both fails or is underestimated, it may jeopardize the quality of the product [9].

Integration of Gamification Elements. The idea of integrating a game into the Mobeybou in Brazil app resulted from the knowledge that gamification activities provide a good opportunity to reinforce learning [18]. Gamification is the process of designing activities and experiences that are similar to games [19, 20]. Gamification can be used in various situations and for various purposes. Here, we sought to investigate its applicability in educational contexts. According to Lee & Hammer [18], there are three main areas in the educational context where gamification can intervene, namely:

1. Cognition: The trial-and-error process that takes place when the players experiment and discover complex game rules encourages critical thinking, problem-solving and creativity. After an initial phase, the games should be adapted to the player's skills, progressively increasing the level of difficulty;
2. Emotions: Games can provoke emotions in the player e.g., enthusiasm, joy, or surprise, among others. At an early stage, games require experimentation, and often players fail repeatedly before learning to play. Gamification can provide emotional support in this phase of negative emotions and even make them positive, reframing failure as a necessary part of learning;
3. Social: Players can try out new identities. This possibility allows players to explore new facets, for example, a shy player can try to be a leader.

Gamification can be applied using several game mechanics e.g.: points and badges—to quantify the player's actions; levels, quests and challenges—to give insight into the player's progress in the game; and leaderboards and achievements—to compare players, generating competition between them [21, 22].

These elements can be used in educational contexts to motivate children and promote learning by transforming uninteresting tasks into interactive and captivating tasks, maintaining the child's involvement with educational subjects [18].

Regarding story apps, gamified activities can generate more involvement with the story, enhancing learning and providing support for vocabulary acquisition [23]. When developing an educational game, it is essential to bear in mind that children do not yet have the same skills as adults, also it is necessary to consider limitations imposed by mobile devices, e.g., the size of the buttons. According to Miller &

Kocurek [24], it is essential to pay attention to the motor skill required by the game, and to use language that is familiar to children.

2 Methodology

This study followed a Design Thinking methodology [25, 26], comprising five phases: *empathize*, define, ideate, prototype, and test [27].

In the *empathize* phase we sought to clarify the problem and gather a comprehensive knowledge of the theme under investigation. This included a literature review on gamification, User Experience Design (UX Design), User Interface Design (UI Design), as well as an analysis of the Mobeybou DM.

In the *define* phase, we synthesized the information collected in the previous stage, identified opportunities, and established requirements. We then defined the types and profiles of possible users. We developed a navigation diagram with user flows, mapping all the screens and the route that the users would take in the game.

The *ideate* phase was dedicated to the design and exploration of various interface solutions to find the most viable one and advance to the next phase. Outgoing from the navigation structure defined in the user flows, we designed wireframes to obtain a low-fidelity representation of a possible solution. Visual design decisions were made regarding typography, chromatic, and UI elements, which resulted in a visual interface design.

In the *prototype* phase, we developed an interactive version of the interface that was used during the design process to communicate ideas and get feedback on the interface's progress.

In the *test* phase, we carried out a series of usability tests to evaluate the usability and effectiveness of the proposed solution with the target audience. Based on the results obtained, problems were identified and subsequently corrected.

We collected demographic information on the use of educational games on mobile devices via online surveys involving children, parents, and educators. In total, we collected responses from 37 children, 42 parents and 12 educators.

In the following section, we will detail the various phases of the development.

3 Design and Development of the Game Interface

3.1 Phase 1—Empathizing with the Product

Following the Design Thinking methodology, we started by defining the problem and its limitations, therefore, several meetings were held with the Mobeybou research team to understand the project and the concepts behind the development of the materials.

We then collected information about the potential users. This helped to make decisions based on their needs and interests, as well as to create the profile of the potential users of the game. We have collected data via online questionnaires with our target users. We collected a total of answers from 37 children, 42 parents, and 12 educators. The results of the questionnaires showed that 24% of the children use mobile devices for less than 30 min a day; 30% use digital devices between one and two hours a day and 46% use mobile devices between 30 min and one hour per day. Children's preferred activities are playing games and watching videos, followed by browsing the internet and reading stories. In the games category, children prefer puzzle games, followed by action and adventure games, Legos, and memory games. Around 57% of the children stated that they occasionally play educational games, whereas 20% do not usually play games.

Regarding games, parents consider that the most important thing in a game is to foster reasoning, strategic thinking and learning to accept defeat. Twenty-eight parents (66.7%) reported playing games with their children and having preference for educational, puzzle, and/or adventure games. Around 52%, stated that their children have the habit of playing games, while 38% inform that their children play only occasionally. Some parents stated that their children ask them for help when they do not know how to interact with technology, and that most of these problems are related to information architecture and navigation.

From the twelve inquired educators eight (66.7%) said that they use games for teaching; three (25%) use games occasionally and one does not use games at all. The used games range from analog games such as naval battle or multiplication tables, to interactive platforms. All the educators in the study believe that games contribute to increasing children's learning motivation.

3.2 Phase 2—Defining the Problem

Creating Personas. Following the information obtained in the previous phase, we synthesized the collected data and created three potential user personas [28]. Personas are fictitious representations of possible types of users who may use a product or service [29]. These fictitious representations are created based on the characteristics of real people and provide a way to empathize with the potential users and understand their behaviors, goals, and needs [28]. Keeping potential users in mind helps to make decisions according to their needs, which in turn contribute to creating meaningful user experiences. Based on the information collected in the previous phase, we have created a persona for each type of user, namely, children, parents, and educators (see Table 1).

Creation of the User Flows. Based on the information collected in the previous phases, we created a user flow focusing on the child's persona to design the navigation within the game (see Fig. 2). The user flow describes the connections between screens and the sequence of steps that the user takes from the beginning to the conclusion

Table 1 The user personas

João Silva Child 5 years-old	Ana Silva Mother 40 years-old	Maria Gomes Primary school teacher 45 years-old
Characteristics		
• Enthusiastic and curious • Enjoys watching videos, playing games, browsing the internet, and reading stories • Uses the Tablet on average 1 h a day • Usually finds it easy to interact with games or apps • Occasionally plays educational games • Prefers puzzle, action, adventure, Legos, and memory games	• Often plays with her son • Prefers educational, puzzle, and adventure games • Has low technological proficiency	• Uses multimedia content to teach • Often uses games in class • Uses interactive platforms as an educational complement • Believes that educational games contribute to increasing children's learning motivation
Use case		
João likes to read stories and play games. He wants a fun game to play while learning new things. Because it's an educational game, maybe his parents would let him play longer	Ana has a 5-years-old son who knows how to use his tablet and loves to play games. The games that her son plays don't have educational content. She is looking for a fun educational game that her son would be interested in	Maria is planning the weekly class on the countries of the world. To complement the school manual, she looks for an engaging way to teach children about the culture of a particular country
Needs		
• Learn in a fun way • Easy to use • Accessible language	• Games with adjustable difficulty level • Interactive mini-games • Possibility to share with friends • Monitor the child's progress • Games with narrator or guidance	• Educational material with challenges • Didactic games • Solutions for creating stories • Digital solutions to complement the class
Goals		
• Learn to read better • Develop cognitive, social, critical thinking and creativity skills	• Teaching English to her son • For her son to exercise or develop cognitive skills • For her son to learn to accept defeat	• Teach her students captivatingly and effectively • Develop her students' creativity, writing and narrative skills
Frustrations		

Table 1 (continued)

João Silva Child 5 years-old	Ana Silva Mother 40 years-old	Maria Gomes Primary school teacher 45 years-old
• Having little reading autonomy • It takes some time to read • Asking for help (can't find something, having doubts about how to play or when making a mistake) • Unknown or difficult words	• Some games are not adapted for small screens • Too much distracting information in the game • Excessive advertising in free games • Free games with additional paid features (freemium) that her son could buy by mistake	• School manuals are not attractive; they don't arouse curiosity in children • Limitation of multimedia equipment in schools • Manage conflicts because of competition in the game between students
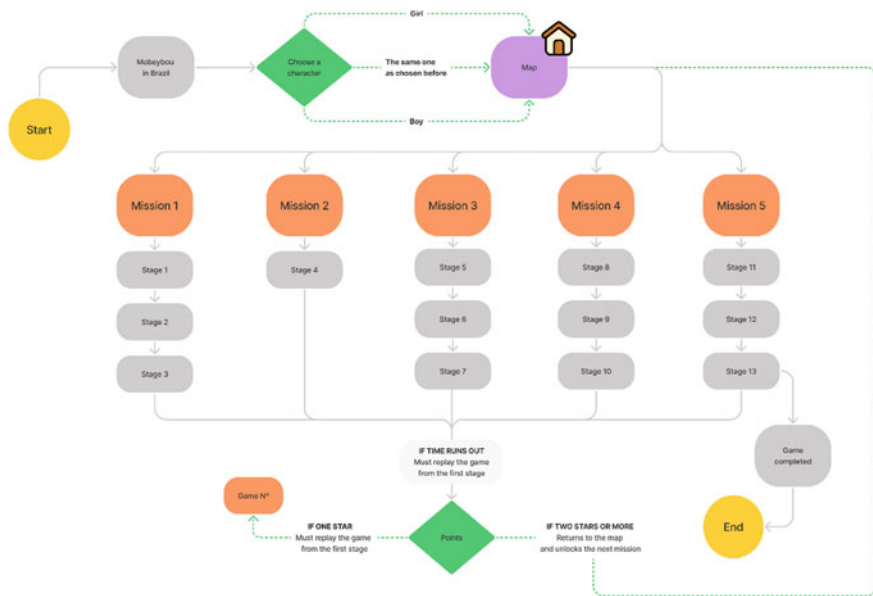
Fig. 2 User flow of the possible solution for the game

of the game. The user flow helped to organize and structure the game screens and to plan the gamification techniques.

As previously referred, the game is integrated into the story app Mobeybou in Brazil. Like the reading activity, the user can choose between the boy or the girl character to play the game. The game is made up of a series of missions, some consisting of several stages. A stage refers to the task that the user must complete. For example, in the first mission, the stages are the objects that the user must find. The missions, including their stages, have a time limit for completion. The time limit

must be sufficient for the user to solve the task while preventing her from randomly trying out various options.

Along the missions, the user needs to remember parts of the Mobeybou in Brazil story to complete the tasks of each stage. To facilitate this, we created a feedback button. When clicking the button, the user accesses information about the respective task. In some stages, it is possible to use the feedback functionality twice. Since the missions have a time limit for completion, the user needs to learn to manage the time s/he spends reading the hints. For each completed stage, the user receives one star. The only exception to this rule is the second mission, which only consists of one stage. At the end of each mission, the user is awarded stars according to his performance. The following mission is only unlocked when the user gets at least two stars, otherwise, she will have to repeat the mission.

3.3 Phase 3—Ideation

This stage is aimed at generating and testing different interface solutions. Outgoing from the user flow previously created we designed various wireframes and created a visual system for the construction of the game screen, considering typographic, chromatic, and the choice of UI elements.

Development of Wireframes. Following the creation of the persona's models and the user flows, we created the wireframes of the various screens of the game. Wireframes are structural drawings, in the form of a sketch that represents the content of the screens of an interface (see Fig. 3). The sketches make it possible to quickly experiment with various interface concepts without compromising the visual aspect.

Fig. 3 Low-fidelity wireframes with and without the Mobeybou's graphics applied

Their purpose is to investigate not only the usability but the information architecture of the interface, without considering visual design options, e.g., choice of colors or fonts. The sketches helped to organize the content of the application and to communicate ideas, allowing us to gather feedback and validate possible solutions with the Mobeybou team. Getting feedback early in the design process prevents wasting time on solutions that may not be feasible.

As the game is part of the Mobeybou set of materials, to test the flexibility of Mobeybou's graphic language and to understand its limitations, we have developed several low-fidelity wireframes using the Mobeybou's graphical elements to organize the interface and gamification elements, as well as to open the discussion to the rest of the team who might have difficulties interpreting grey wireframes. The wireframes made it possible to discuss ideas and adjust the direction of the project with the Mobeybou team, which was fundamental for the design. The wireframes showed that the game interface would need several elements that did not exist yet.

Development of the Visual Design. Following the wireframe studies, we began developing the visual elements of the game interface. The design of the interface elements followed Frost's atomic design system [30], a methodology that starts from the design of smaller components for the constitution of larger components. This process is inspired by an analogy observed in science where atoms compose the main structures of nature, which in turn build other elements. In the case of design, this can be seen in web pages that can be divided into smaller elements. For example, a web page can be split into sections like the header, which in turn can be split again into smaller elements, like text and images.

This method ensures the cohesion of the interface and the visual language, as well as producing reusable elements. Therefore, the smallest elements of the game interface, e.g., typography, color, iconography were first defined and were followed by the layout of the mission screens.

Regarding the font, Mobeybou uses the Sassoon typography, a sans-serif typeface, with a calligraphic and rounded design, inspired by the writing of children. It was created by Rosemary Sassoon, who investigated which are the best typographic forms for children to read [31]. In partnership with font designer Adrian Williams, she developed several typefaces intended for teaching reading and writing. As Sassoon is a font developed to meet the needs of the children, this typography was also used in the development of the game interface.

Regarding the color scheme, the colors used in Mobeybou were used to create a chromatic palette. We have identified three main colors: red, the ground color of Mobeybou, which is also the color of its logo; green, obtained by the vegetation and landscapes of the countries; and, browned yellow, which is used in text boxes of the apps (see Fig. 4). To make the color palette more versatile, a darker color was added for each color.

The green and red colors were chosen because they have useful connotations for the game. Red is recognized as representing danger, while green has the opposite meaning. Since in the game it is necessary to indicate the result of the users' actions, this chromaticism is convenient as it forms part of a universally recognized code.

HEX #FFDE98
RGB 255, 222, 152
CMYK 0, 13, 40, 0

HEX #68BB60
RGB 104, 187, 96
CMYK 44, 0, 49, 27

HEX #F15E58
RGB 241, 94, 88
CMYK 0, 61, 63, 5
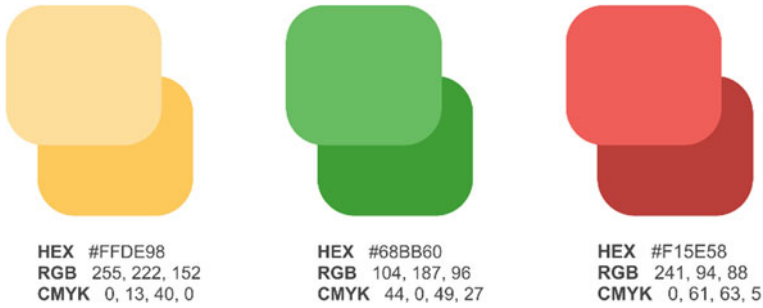
Fig. 4 Mobeybou's color palette

Mobeybou's iconography has a defined and justified visual style, inspired by the crayons used by children. For this reason, we decided to keep the visual appearance of the icons and create new ones based on the existing graphic standard (see Fig. 5).

One of the problems detected through the wireframes was the visual inconsistency created by the different shapes and dimensions of Mobeybou's illustrations. We have explored alternatives to visually balance the illustrations presented on the game screen by using a shape to delimit the area of the images (see Fig. 6).

Using a shape to contain the illustrations helps create congruence in the images. After several explorations, we have decided to use a square shape with relief at the bottom, which gives it a three-dimensional appearance.

This option was chosen because it is a reference to Mobeybou's DM, which is composed by square blocks. Thus, a child who was used to playing with the blocks would recognize their functionality through the shape. The previously defined color scheme was used to create the visual feedback of the elements when they are chosen correctly or incorrectly. The crayon texture used in the icons and the rest of Mobeybou's visual language were used in the outline of the game blocks.

The three-dimensional appearance of the blocks was the key concept for the interface. Based on this concept, the remaining UI elements of the interface were developed, namely, the time bar that shows how much time the user has to complete the mission and the text boxes, e.g., the tips and the text at the beginning of the missions.

Change
character

Consult
history chapters

Use
a hint

Repeat
mission

Next
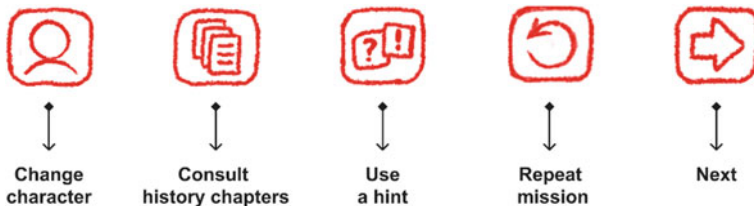
Fig. 5 Mobeybou's iconography
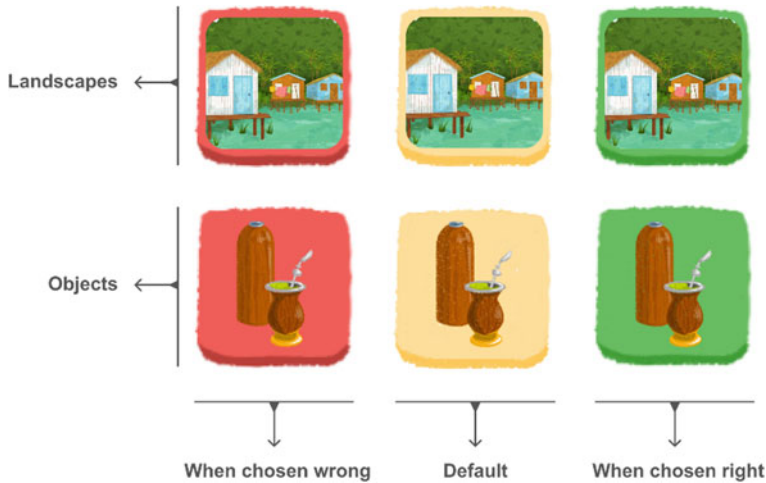
Fig. 6 Game blocks stages

The time bar makes use of the defined chromatic palette. The bar is divided into three parts. At the beginning of the mission the bar starts filling and over time when reaching the intermediate and end time, the bar changes its color.

Concerning the feedback hints, the graphics of the blocks were also used, creating a legible area where text could be placed. This solution was not only used for the feedback hints but also in other representations, for example, for the initial text of each mission, for modal windows, or other types of pop-ups.

Having defined all the necessary elements, we created a layout to inform the construction of the game prototype.

3.4 Phase 4—Development of the Prototype

Development of a High-Fidelity Prototype. During the design process, several partial prototypes were created to help understand the navigation flow through the game and support communication with the Mobeybou team. The prototype was something that evolved throughout the project and underwent several changes as the design process unfolded.

After defining the UI elements of the interface, the visual design was implemented in the final wireframes. In addition to the visual aspect, the texts and cultural elements of each mission were also inserted. The result was a functional mobile app developed by Mobeybou's programmers, ready to be tested with future users (see Fig. 7).

Fig. 7 High-fidelity prototype screenshots

3.5 Phase 5—Testing the Game Interface

One of the ways to study, evaluate and validate the usability of a given product is through usability tests. The tests are carried out with representative users of the product and aim at detecting usability problems and identifying opportunities for the improvement of the design [15].

Based on this knowledge, in this phase, we conducted a pilot test with the target audience, to evaluate the usability and effectiveness of the solution.

Usability testing. The usability tests were carried out with a mixed group (boys and girls) of five third graders, aged between 8 and 9 years-old. The tests were performed with the high-fidelity game prototype. The children interacted with the prototype individually, and each test lasted approximately 15 min. Table 2 shows the tasks that the children need to complete.

The data collection focused mainly on qualitative analysis, observing the children's behavior and reactions during interaction with the prototype. The tasks were rated as completed/uncompleted according to each child's ability to finish the task seamlessly.

The usability tests revealed that the interface achieved a 96% success rate (see Table 2). According to the observations made during the usability tests, we concluded that all the participants were able to perform the proposed tasks.

Regarding the user experience, all children considered the experience positive and enjoyed playing the game. All said that the game was easy to play and that their peers would have no difficulty playing it.

Table 2 Usability testing: tasks and results

Task number	Task	Success rate (%)
1	Entering the game	80
2	Starting the game with the girl character	100
3	Playing the first mission	100
4	Using a hint	80
5	Consulting the story chapters	100
6/9	Playing the second, third; fourth; fifth missions	100
10	Change character	100
11	Understand in which mission are you	100
Total success rate		96

4 Conclusion

We presented a descriptive case study of the design process of the graphical interface for the game integrated to the story app Mobeybou in Brazil. The main goal of this process was to develop an intuitive and easy-to-use interface directed to pre-and primary school children, and contributing to the reinforcement of language skills, creativity, and digital literacy.

The process began by analyzing the Mobeybou materials, particularly the story app Mobeybou in Brazil. The design thinking methodology guided the development of the project. Along the design process, we have used several methods, such as surveys, personas model, user flows, wireframes, and prototyping. The design tools, especially the more visual ones, such as the user flows and wireframes, made it possible to communicate ideas and plan the next steps, aligning the entire team in the process.

During the entire process, the central point was the user's needs and cognitive limitations intrinsic to the project age group. This cooperation between designer and user was essential to achieving this result.

The limitations found in the development of this work were the restrictions caused by the COVID-19 pandemic. Given the situation, it was necessary to find alternative solutions to those initially planned. For example, the usability tests had to be carried out with a limited number of participants. Despite these limitations, the results obtained were not impaired. This change caused a slight delay in the study but did not affect its results.

The validation of the interface through a usability test revealed a success rate of 96%, thus ensuring an intuitive and effective use by the target audience. The tests also showed that the interface promoted a high degree of satisfaction by the users. Finally, the visual system developed during the project provided design patterns that may be useful in the expansion of the game or, in the future, in the elaboration of other cultural games.

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Hermeneutic Methodology to Design the Skin of the City

Liliana Soares and **Ermanno Aparo**

Abstract This paper support the concept of skin as design's control to create building's epidermis. The first part develops the meaning of skin and its interpretation, considering time, space and circumstances. The second part analyses several case studies that define western reality between Ancient Egypt and Art Nouveau. Methodologically, the paper is based on hermeneutic approach. With this new philosophy in mind, the authors want to prove that although it is risky and cloudy to—summary—analysis the main conceptions that were found throughout past, it is also a strong and singular choice without the prejudice of history. For this reason, it is a choice that takes on the power of semiotics, culture and knowledge. In this research, the authors avoid the critique of architecture—that catalogs space in typologies, such as, religious, private and public—in order to choose the right of autonomy to judge the skin of buildings as images that adds new data, and interacts with the users, connecting ancient symbols with current symbols that provoke sensations and emotions. Ultimately, the paper relates knowledge in a dynamic way, assuming elements from different cultures, in a recyclable and sustainable way.

Keywords Hermeneutic as design methodology · Semiotics as design competence · Scenarios construction

1 Introduction

Etymologically, skin means the outer covering of the body, the cutis, the epidermis [1]. In this study, the authors will consider the different meanings of the word, without neglecting any one [2], considering all hypotheses, even if they are average

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conjectures. In its application to design, one should consider satisfactory hypotheses [3] before stating by one.

On one side, the Latin word cutis means taking care, wrapping something, the exterior of a thing, the varnish or the appearance [4]. Cutis shows an approach to the scope of design as the skin that takes care of something—which in this case could be the building or the outer shell of the building. On the other side, the word epidermis is a semi-transparent membrane that covers the skin and forms the outer lining of the skin [5]. The epidermis is an image made up of a group of small parts that are always in circulation, which are recycled. It is a sensation "(…) reduced to a group of molecular movements. And the image, an essential element of psychic life, will appear in due course in this reconstruction, it will come to occupy a previously determined place in it" [6]. Therefore, the epidermis of a body is sustainable semi-transparent, a very thin layer that covers the skin of the body, as if the epidermis is a project integrated into architecture, but projected by design.

With this idea in mind, liquid reality [7] requires thinking about the epidermis as an essential part of the building's skin, because it is the first image that interacts with the user, that provokes sensations, that stimulates him/her, attracting or pushing him/her. Therefore, at this point, following the foregoing considerations, the research questions were: In order to interpret it today, historically, how does this exterior skin took care of the building? What does it mean to take care of an object? And how and why can design create competences to take care of existing buildings? In order to develop this thought, it is important to relate design with other fields, as suggested the hermeneutic methodology proposed in this research, instead of trying to find the differences and product-oriented meanings. In particular, in order to be objective, regarding both the design honesty and the appearance(s) that the city's surface intends to communicate today.

In this study, the authors chose to learn with history before the impact of Modern Movement on building surface design. This limit in time is related with the absence of industrial production, considering that this process would raise other considerations in the analysis as the absence of ornament in semantic process and the introduction of new materials that might create noise in the present analyze. Therefore, in this paper it seemed important to understand the creativity process among fields since Ancient Egypt until Art Nouveau period. The analysis of the surface history of buildings from the Modern Movement to the Liquid Reality is important, but it will be an exercise for another study.

Appearance is a reference to the relationship established with the essence of the object. That is, in order to create a relationship between the appearance of the building and its essence it is essential to constantly consider the process of appearance. The multiple appearances possibilities of the building must be revealed, therefore, all the hypotheses of the meaning of the word surface are weighed as a phenomenon, changing with time, space and circumstances. The designer who imagines the external surface of a building thinks of images hypothesis as something that is always renewable and evolving. The designer considers the image as the skin of the building, knowing that it is made up of different vertical layers and that the top layer is the epidermis, which is organized by parts that are in permanent circulation.

An image that will first provoke the experience of sensation about the building, and after the experience of knowledge.

In this paper, the idea of the epidermis as a skin that adds new data is expressed as the essential part of the building's skin. It is the image that interacts with the user, which provokes sensations and stimulates him/her. Although, if human being wants to live an experience of knowledge, it is necessary to relate ancient symbols with current symbols. The designer, as a storyteller, relates to knowledge in a dynamic way, assuming elements from different cultures, in a recyclable and sustainable way, because he/she lives in the context, with meanings and sensations.

2   Methodology

If we want the principles of hermeneutics to be applied in the understanding of material culture, all the factors—new and old—that compose the context, must be enunciated. For Hans-Georg Gadamer, the appropriation of the concept of hermeneutics takes place when something is made understandable or brought to the correct understanding. "Hermeneutics is the practical art, that is technë, involved in such things as preaching, interpreting other languages, explaining and explicating texts, and as the basis of all of these, the art of understanding, an art particularly required any time the meaning of something is not clear and unambiguous" [8]. Hermeneutics thus, presents itself to design as a science that, through cultural signs, dissects, fragments and explores problems. Then, interpretation is a performing and circular act between the whole and its parts. "When designing, designers are continually being questioned. They can facilitate that process by laying themselves open to the questions, leaving themselves vulnerable, at risk, by taking the questions as a probing of their prejudgments; or they can proceed in a one-sided manner, asking questions of the situation, but protecting their pre-established biases by not allowing themselves to be questioned in return" [9], which means that for designers hermeneutic cycle is a process-oriented process. Therefore, in this study hermeneutics is a methodology to think the skin of the buildings.

3   Case Studies

In past, urban places were seen as scenarios of important events, of ways of adapting to public and private spaces, of social and cultural expressions. Today, the metropolis appears to be a complex and fluid object in the relationships between people, goods and information. So, it is difficult, sometimes, to define and distinguish the limits between public and private. In the contemporary city, it is possible to design an exterior spatial module in the public space—like a micro-architecture—as it is possible to project an interior spatial module in the public space—as in a shopping center. In the urban territory, there are some periods of the City's History—such as Ancient

Table 1 Premises to design the skin of buildings

Heading level	Example
1st level of design	It is essential to enunciate singular and conjectural responses oriented towards new solutions that meet the demands of the **present moment**
2nd level of design	Diagnosing the complexity of factors as something that must be done **continuously** and not something that we can do or cannot do
4th level heading	It is interesting to think about the uniqueness of the surface of the buildings with an inspiring interpretation model that starts from a basic concept—which stimulate evaluation and re-evaluation—before giving an answer. The design of the interpretation of the skin of buildings is **hermeneutical** and **dialectical**. The surface is one of the components of the scenario that interacts with the human being

Greece—that clearly defined and elected the 'Àgora' as a public space of collective belonging. In other cases, public circulation spaces—such as the street or the square—suffered an appropriation sometimes disordered as happened, for instance, in the European cities of the medieval period.

Specifically, the design of the wall—as the part of a building—can be seen as the essence of design language, the starting point for a new experience between what is inside and what is outside a building or a moment in where the experience actually happens. It is the edge of not returning to the previous, without completely refusing the previous—which in this case one can consider as interior space—and the posterior—the external space—can be called the edge of the experience of ambiguity that could be interpreted as a phenomenon of understanding. When the process of perceiving what happens on the edge between the two spaces, contemplates the cultural context, it is a comprehension and includes and considers several factors such as culture, time, and environments and, it is not an isolated act.

Thus, this paper analyzes the history of building skin in the western reality. Although, as Christian Norberg-Schulz [10] argues, this is not a history of the facade or the history of the epidermis of buildings, but the choice of some of the most important appearances and critical moments. An archeological methodology of fragments that can start, for example, in the eighteenth century and end in Post-Modernism, as Manfredo Tafuri states in his book: 'The sphere and the labyrinth' [11]. In this case, the research starts on the Ancient Greece and ends in the Art Nouveau.

From this reflection, 3 main points stand out in order to design the skin of buildings as it is written in Table 1.

3.1 Case Study: Ancient Egypt

As stated by Friedrich Hegel, Architecture in Ancient Egypt born out of the need to express itself, so everything is symbolic. "(…) Such a meaning also has the number of columns; and the images, which belong to sculpture like memnons, sphinxes, etc.,

are not just works of sculpture, but also of architecture, to which they belong because of their colossal structure" [12]. The power of the image was very strong assuming the role of scenario between a Person—the pharaoh—that intends to transmit an omnipresent message to a receiver—the people—trapped in this expression. Whether close or far away to buildings, the architecture ensured that the receiver knew the meaning of the referent—the pharaoh.

Thus, the facade of buildings was used as a support to communicate a message. Concerning the presence of hieroglyphs on the facades of the buildings, each symbol had a meaning and a specific placement on the walls of the royal palace. "The serekh is the first format of the king's name in hieroglyphics, comprising phonetic signs, placed within a project for the palace facade, which was dominated by the image of a falcon" [13].

3.2   Case Study: Ancient Greece

In Ancient Greece, the facade of a building was the place for political power to communicate with the city, expressing and witnessing its strength. A case that exposes this reflection is the Parthenon, built by Pericles on the Acropolis of Athens, under the supervision and the responsibility of Phidias—who was also delegated the design of the decorative sculptures and the design of the architecture of Ictinos and Callícrates. On the facade, specifically, "in the metopes, the obsessive repetition of themes that refer to mythical conflicts restores to the spectator the ancient image of a city that symbolizes all Greek culture as a civilization opposed to barbarism. At the same time, the pediments celebrate the goddess with the main myths they refer to, namely the Pan-Hellenic of her birth and the place of conflict with Poseidon for the conquest of Africa" [14].

From this perspective, the analysis of the facade composition system can be inserted in an organic vision of the walls of architecture. A system that integrates each decorative element as a part of the plastic essence of the temple. "The series of multi-colored leaves, the delicate meanders, the exuberant ornaments, the tender and vivid tendrils and flower decorations are never superimposed from the outside to animate a dead surface, like decorative accessories, like ornaments, but forming joints, connections and the supreme conclusion of the building as a mediating 'expression', in those points where the bases and the weights meet or are extinguished" [15].

3.3   Case Study: Ancient Rome

In Ancient Rome, the relationship between the exterior and the interior was materialized through richly ornamented facades, revealing "(…) the skill of a courageous and enterprising population, in an external and reassuring model about security

in the future" [16]. Roman society used the surface of the city—buildings, equipment, ephemeral architectures or micro-architectures—to demonstrate the meaning of power to the exterior.

As Thomas Hope argues in an analogy about the importance of covering in Roman architecture and Greek culture, "the ancient Romans, on the contrary, made great use of bricks; either because it was a common material among themselves, or because they found it easier to work with than stone. Not only were they laid out in horizontal planes to form, as we still do today, the body of the walls, but they were also used for the exterior cladding, and thus the subtlety of the raw material of the bricks, as well as the solidity of the cement with which they were connected, ensured that the buildings lasted as long as this one was built in stone" [17].

3.4 Case Study: Muslim Culture

In Muslim culture, the analysis of the epidermis of buildings must take into account religion, so the house is closed to the outside world and, it is opened to the interior. "The simplicity of the facade is well accused because it does not deserve attention: they are walls that seal off, that drastically separate the exterior from the interior" [18]. In the Muslim house, for instance, the sense of the street does not exist, hence the buildings appear in a way that, not only does not allow the idea of perspective but also, not accept one to look from the outside to the inside of the building. Likewise, in the surface analysis of Muslim buildings, the existence of a courtyard inside the house must be considered, which is justified by the climate and the influence of the Roman tradition, given that the design of Muslim housing adapts to the concept of life of an individual turned to faith in God. If the exterior of the facade of a Muslim dwelling appears neutral, the interior of the Muslim facade has a symbolic significance, especially when one think of religious buildings, such as 'mihrab' whose representation of the door is intentional. So, as if the door referred to the house of God, "undoubtedly, the door it represents is an exterior facade, a facade whose model continues in this mosque from the seventh and ninth centuries to the twentieth century" [19].

The semantic value of the Muslim facade depends on the immaterial referent (God) represented in Mecca, therefore, in the Muslim household—whether in domestic or social life—the interior facade opens to connote the exterior of a symbolic referent and the Exterior facade closes to hide the essence of the individual's intimate life inside. For a non-Muslim user, the outside of the mihrab is the appearance and the inside is the essence, and the edge between the two is an access to achieve knowledge about a culture. For a Muslim user, seen from the outside the mihrab wall is the appearance, but when he/she is inside and seeks the essence he/she finds a new appearance, in the form of an open door, which is the exterior of the same symbolic referent. The analysis of the epidermis in Muslim culture must take into account cultural and symbolic factors, material and function.

3.5 Case Study: Middle Ages

In medieval times, the transmission of meaning and the symbolic value of the facade are evident in ecclesiastical architecture. The building becomes a vehicle for spreading the Christian message, moving from a bare structure to a manifestly decorative prosperity. The biblical narrative component, which before this period was limited to the frescoes present inside churches, is now represented on a sculptural support and placed on the facade. In the medieval facade, the communicative insertion gradually helped to improve the relationship between the structural elements and the sculptural parts. Thus, improving its plastic effect and increasing its visual lightness. "This is a formulation of the relationship between sculpture and architecture inevitably compatible with the tendency to steal any sense of wall from the facade, replacing it with the crosstalk of windows, becoming dominant, around the thirteenth century, as if check the cathedrals at Reims or Burges" [20].

In a decisive and coherent way, this phase of space construction reinforces the exploration about the hypothesis of evaluating the buildings surface as a subproject of the building that is autonomous and that, in turn, is composed of different layers. As if the surface was composed of a system and the top layer was the epidermis, ready to display both the connotative elements of the interior and the elements that denote the dynamics of people's lives in the outer space.

3.6 Case Study: Renaissance

With the Renaissance, the facade strengthens its symbolic/evocative value, interpreting the building's role as a metaphor for its function and, at the same time, reinforcing the legacy that existed between the structural and symbolic functions of the individual architectural component. The discovery of the Greek classics, in particular the Latin language, has a decisive influence on the rediscovery and study of Greek and Roman architecture. In this sense, the thoughts of René Descartes and Niccolò Macchiavelli will be decisive in the interpretation of the epidermis as a system of components that form a whole and in the analysis of reality as it actually was. As defended by Giusta Nicco Fasola, one of the authors who applies surface composition as a coating system is Donato Bramante. In a text proposed by Leon Battista Alberti on the interpretation of architecture as construction, Giusta Nicco Fasola emphasizes that this argument "is contrary to Gothic decoration, becoming the initiator of an illusionist principle, of forgery,—of which Bramante, in the seventeenth century, will serve himself with greatness and with moral disinterest—for the fetishism of the 'stone colonies'" [21].

With Donato Bramante, the covering—understood as a part of the building's body—acquires a projectual autonomy in relation to the whole. One case that support this rule is the facade of Santa Maria Nuova's cathedral. Designed in 1497 in Abbiategrasso, Milan and attributed to Donato Bramante, the facade emphasizes design

independence and the importance of epidermis as an element that takes care of architecture. Regarding this point of view, the interest in construction was moderate as an expression of Mannerism. In addition, men get used to create beauty on the surface of the buildings and, to merely consider technical the constructive aspect of life.

3.7   Case Study: Baroque

In Baroque, the growing centralizing political force of the church/state has a decisive impact on architectural dynamics. The strong symbolic value, together with the equitable rigor, transform the relationship between the interior and the exterior of the building's surface. For Christian Norberg-Schulz, "persuasion and propaganda only become significant in the relationship with a center that represents the basic axioms of the system" [22]. Architecture finds a very strong role in the theatricality of the baroque city, a function that both architecture and other arts assume, dazzling and educating the people who were, for the most part, ignorant and illiterate.

3.8   Case Study: Art Nouveau

Art Nouveau manifests itself considerably in Brussels, due to the good reception for new artistic works. One of the authors who better worked the skin of buildings was Victor Horta. As Sigfried Giedion argues for the 'Maison du Peuble' (1897), "Horta broke the facade wide open, and filled it with glass and iron" [23]. The practical function was controlled by iron, glass and bricks, helping Victor Horta to define the body of the building and, consequently, to calculate its support. In terms of symbolic value, as Paolo Portoghesi states, in the 'Maison du Peuble' "the symbology based on the equation 'transparent facade: = air-and-light-luxury-of-the-poor' (i.e.) is intended to perpetuate itself equally in the more radically revolutionary attempts of the avant-garde, from Gropius to Russian constructivism" [24].

The use of iron and glass on the facade of the 'Maison du Peuble' transforms the design of the skin of buildings into a very interesting case of perfect symbiosis between structural and symbolic functions. An intense relationship between the facade that seduces and speaks to a user who is also predisposed to be related to it, taking a long look at it, like someone who is looking into a mirror in order to discover another being reflected and transformed. Something that Renato de Fusco defines as "empathy, understood more broadly as the intimate relationship between architecture and those who enjoy it, between architecture and the environment, in the most typical works characterized by the cult of line as in those characterized by the cult of the plane" [25].

During the Art Nouveau period, the facade of the 'Maison du Peuble' was an example of how the skin of the building could be interpreted as a critical moment of synthesis between structural function and decorative balance. This was also an

occasion to reinforce a political message, determining contact between social classes. As Angelo Trimarco points out, "it is not a case, moreover, that, marking the image of this 'unique factory', as De Fusco called it, Horta wrote on the terrace's balustrade words and names such as Science, Cooperation, Labour, Karl Marx, Proudlhon, Fourier, Robert Owen: names and words, certainly significant, surpassed, however, by the name of the building itself, La Maison du Peuple" [26]. In this work, the project of the building's epidermis was conceived autonomously as a subproject of the whole. Guided by design, these autonomous prostheses emerged from the facade to ask for identity.

4 Conclusions

In this study, hermeneutics was interpreted as a project methodology, because the hermeneutic cycle presented itself as a cyclical and renewable alternative and, therefore, it became a knowledge hypothesis about the nature of things. Semiotics was interpreted as a competence of design, because it allowed the exercise of semiosis, the association of signs with other signs in a labyrinthine path that only allowed for progress. Therefore, it became a continuous transformation. A proposal for the production of signs and images that changed in the context. Thus, semiotics enhanced a hypothesis of intuition and hermeneutics became a technique to explain design method in the twenty-first century, supporting the thesis of crossing several types of observations and connotations. Concerning this research, it means that in the future it will be possible to project the skin of buildings by applying a regenerable and cycle methodology.

In this paper, the skin of the buildings was entitled cultural and knowledge things interpreted by the design process. It was about understanding design as a field that is in an interrupted renovation. The first moment is nebulous and the second moment is universal and is experienced in the edge of becoming a cultural experience for the user. An action that benefits from the fragmentation of time and searches for cultural signs of the past accomplished of giving meaning to the user. Specifically, it means that the skin of buildings has a nature, a potential that asks to become something in the moment. This potential of the building's essence must be understood in the fluidity and ephemerality that define our time. A contradictory reality where, perhaps, there is no context, where nothing and everything has already been created, a moment that represents the idea of function and meaning and not form.

So, if we want a singular moment between the user and the building it is imperative to create a connection with the skin of the building, producing the experience of sensation and, with it, the practice of emotion. Hence, the aesthetic experience is very important to create an attraction between subject and surface. As this is an ongoing research, in this first level of knowledge, the surface will consist of a system of parts that establish a relationship with the individual, assuming a message of sensations, knowledge and cultural content.

The analyzed case studies from the past will serve as a reference for the future research to produce a diagnosis of the complexity of factors that define the current reality. An action that is practiced continuously and not something we can do or not. In other words, although architecture is based on historical and semiotic reasons, it does not means architectural solutions are the model for interpretation. Thus, using hermeneutic methodology to design the skin of the city means applying a technique that considers complexity, uncertainty and ephemerality. A methodology that crosses old symbols with current symbols to design with the sense of future things that create emotions and knowledge in people's life.

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Visactivism: A Conceptual Model to Identify Information Visualization as an Expression of Design Activism

Pedro Duarte de Almeida

Abstract Can Information Visualization be an expression of Design Activism? This question leads an exploratory research that seeks to identify parallelisms between these two domains of design practice. Following an interpretive approach and a case study methodology, the research focus on three Information Visualization projects aiming to identify Design Activism characteristic attributes, namely the kind of motivation, purpose and discourse inherent to these projects. The results show that a visualization may be an example of Design Activism when three conditions are combined: the project is motivated by the ethical stance of the designer towards a specific cause; the designer aims to contribute to the disclosure, awareness and/or public discussion about the subject addressed; the visualization is designed as a persuasive discourse that challenge and/or influence the end user. These results allow us to propose the conceptual model of Visactivism that describes the practice of Information Visualization as an expression of Design Activism. As well as nurturing the relationship between the field of Design Activism and the specific domain of Information Visualization, this model is also a theoretical contribution to deepening the interpretation of the specific foundations, objectives and characteristics that identify Design as an Activist practice.

Keywords Information visualization · Data visualization · Information design · Design activism · Visual communication

1 Information Visualization as Information Design

Visible reality is not restricted to what the human eye is able to see naturally, but is significantly increased through instruments that expand the spectrum of visibility to phenomena that are not even of a visual kind. Just as certain technical instruments, such as the microscope or the telescope, expand the natural reach of human

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eyes, graphic devices like maps, diagrams and charts also enable the perception and understanding of different invisible, abstract or complex phenomena [1]. The specific features of these phenomena, combined with the need to explore, analyse, discover, understand and communicate this kind of information, are the key factors that motivate the design of diverse visual devices that allow us to envision information and encompasses a wide field of image production that is now called Information Visualization [2].

The relationship between Information Visualization and Design can be understood if we call upon the *design as interface* definition proposed by Bonsiepe [3]. According to his conceptual model, design is ontologically constituted by the triangular relationship between a user, a tool and an action with a specific purpose. In this context, the user is someone who needs to perform a certain task, whether of physical or cognitive kind. The tool is the artefact, material or immaterial, necessary to perform that specific task, and it encompasses both physical and semiotic devices. The purposeful action refers to the performance needed to accomplish the addressed task and assumed as the design's predetermined goal (e.g. analyse data, understand a complex process). This three entities are related through the concept of interface, understood here as the practical and utilitarian interaction that shapes the design itself.

Considering Bonsiepe's model, Information Visualization is a design process aimed at representing categories and quantities, relationships and processes, in order to allow observations and interpretations taking advantage of human visual perception skills. It is a process of information organization and representation that aims to make visible and understandable phenomena whose invisibility, abstraction or complexity challenge human understanding needs [1, 2, 4, 5] and it emerges in several contexts and takes on different names (e.g. Data Visualization, Scientific Visualization, Infographics, etc.). Not rejecting those distinctions but recognizing their affinities, Cairo [2] argues that this field encompasses *any kind of visual representation of information designed to enable communication, analysis, discovery, exploration,* etc. (p. 28). In this perspective, visualizing information is an information design process *based on the selection of the presentation method and a layout for the information, taking into account the capabilities and limitations of the visual system* [6] whose result is materialized in diverse visual instruments, like charts, thematic maps, infographics, interactive data visualizations or news applications, that we may simply call visualizations [5].

1.1 The Different Purposes of Information Visualizations

Although having the general purpose of visually present information, a visualization device can be designed with different specific purposes according to the information content in question and the context in which that information will be used. Iliinsky and Steele [7] distinguish between two general types of visualization according to

two essential functions: exploring and analysing data or explaining and presenting previously synthesized information.

As such, an **exploratory visualization** is designed to analyze and interpret data in order to extract meaning from it. It allows disclosing new information and it may be used, for instance, when an analyst draws a scatter plot to look for a relationship between two different statistical variables.

In turn, an **explanatory visualization** is a communication tool that aims to display previously synthesized information and its purpose is to explain a certain issue to the end-user. Thus, this type of visualization can be exemplified by a newspaper's infographic through which the reader can get a detailed overview over a specific issue (e.g. accident, sports event, etc.).

This distinction proposed by Iliinsky et al. [7] has the virtue to distinguish between two primary purposes for Information Visualization: explore data to discover new information or explain and present specific information. In this sense, as communication tool an explanatory visualization can be also defined according to the specific relationships that is established between the three entities involved in the communication process: data, designer and reader. Based on the predominance of the relationship established between these three entities Iliinsky et al. suggest three sub-categories to identify explanatory visualizations: artistic, informative and persuasive.

Artistic visualization results from a specific relationship between the designer (or artist) and the data. This kind of visualization does not necessarily aim at an objective interpretation of a certain dataset, such as that intended from a scientific chart or newspaper infographic. Alternatively, it provides an aesthetic experience and may suggest the reader a subjective visual understanding on the addressed issue.

Informative visualization privileges the relationship between the reader and the data, seeking to offer a clear, objective and understandable view of the information in question. It is the type of visualization that is expected to be found in the media, in scientific papers or in statistical documentation, communicating the information in the most efficient and effective way as possible.

Persuasive visualization is based on the primordial relationship between the designer and the reader. For this type of visualization, data is collected, selected and presented in order to convey a specific message, which corresponds to the designer's point of view on the addressed subject. The main purpose of this type of visualization is to influence the user's opinion and attitude towards the subject matter.

Masud, Valsecchi, Ciuccarelli, Ricci and Caviglia [8] also identify three kinds of visualization by its specific purposes. Their categorization is based on a model that describes the Information Visualization design process as a correspondence to different ways of implementing the Data–Information–Knowledge–Wisdom continuum (also known as DIKW), a conceptual hierarchy recognized in several academic fields [9]. Following that model, Information Visualization's design can result in three different types of visualizations: Analytical, Communicative and Formative.

Analytical visualizations are produced in contexts where it is necessary to extract meaning and obtain new information from the exploration and analysis of data, such

as statistics studies or financial markets. In this context, the designer and the consumer of the information visualized can be the same person (e.g. a scientist).

Communicative visualizations represents previously synthesized information or knowledge. The purpose of this type of visualization is to expose information and disclose the meaning, which allows the audience to understand the addressed subject. The use of infographics in journalism is a clear example of this kind of visualizations.

Formative visualizations shares some of the purposes and features of communicative visualizations but differs from it by focusing on the presentation of information in a particular context and for a specific audience. Its distinctive feature is that it approaches the user through a pedagogical discourse and, as such, it tries to affect the decision-making and influence the future behavior of the user.

The two categorization proposals just presented [7, 8] demonstrate that the practice of Information Visualization can have different specific purposes, which transcend the simpler objectives of revealing and communicating information. Indeed, Engelhardt [10] suggests that visualization can be used with the specific aim to raise public awareness on socially relevant issues. He exemplifies this use of visualization with the idealization and implementation of the Isotype [11, 12] system by Otto Neurath (1882–1945) and the use of dynamic graphics to communicate global statistical information within the Gapminder foundation [13, 14] by Hans Rosling (1948–2017). As such, this relationship between the practice of Information Visualization and the communication of social causes suggests the possibility of an intersection between Information Visualization and a specific approach to Design that merges it with Activism.

2   Activism and Design Activism

Activism is the *use of direct and noticeable action to achieve a result, usually a political or social one* [15]. It encompasses different initiatives that aim to transform society in relation to an issue that a certain group of people recognizes as being necessary to change. This may include, for example, boycotting the purchase of products from a company that does not respect workers' labor rights, or disseminating messages and signing petitions demanding that a country's government respect human rights. In any case, these initiatives are characterized by the sense of challenge that involves the demand for a change in relation to the current situation and by the ethical stance that unites the activists around an alternative vision on the addressed topic [16, 17].

Thus, an activist initiative is based on a vision of a better world. Activists are responsible for introducing and affirming new moral values that reflect an alternative view of the future for societies over several different issues and, therefore, are at the forefront of the ongoing process of social transformation [16]. This role in the dynamics of society's transformation is witnessed by multiple global movements that contributed to new frameworks of moral values in which, for example, inequality of treatment between genders, racial discrimination or the depredation

of natural resources are generally considered unacceptable today [18]. In this way, if we consider that political activity does not refer exclusively to institutions and protagonists recognized as 'political' (e.g. parliament, deputies, political parties) but involves all initiatives carried out by individuals, groups or organizations involved in public activities aimed at debating, guiding and transforming society, activism is crucial to the dynamics of democratic life [16].

Like activism, design is also an activity that, in its very essence, aims to transform an existing reality with the aim of improving human living conditions. However, this does not imply that any design process is a form of activism or vice versa. Indeed, although the practice of design can be framed and influenced by values that shape a vision for 'a better society' (e.g. Modernism), activism develops around specific causes (e.g. animal rights' defense). In turn, as a professional activity, design is mainly developed within a socio-economic framework defined by the market logical processes, by production and consumption cycles and by supply and demand law, which contrasts with the context in which the activists initiatives are inscribed [19]. Indeed, these are developed according to a logic of claim and transformative appeal that often questions and challenges the context in which professional design works [16, 20].

2.1 What Is Design Activism

But if design cannot be generally considered an expression of activism, that does not mean that there are not projects that may be identified with this doctrine and its practices. In fact, activism and design are two activities that may share an essential purpose: to intervene in a transformative way in the socio-cultural sphere. Generically defined by Herbert Simon as a projected action that aims to transform an existing situation into a preferable alternative [21], design takes an obvious parallel with activism. Indeed, the relationship between design and activism is already established. Several authors have approached that link [22–25], but Fuad-Luke [20] is probably the one who delved deeply in this matter. He defines Design Activism as *design thinking, imagination and practice applied knowingly or unknowingly to create a counter-narrative aimed at generating and balancing positive social, institutional, environmental and/or economic change* (p. 27).

This definition of Design Activism suggests that there are three characteristics that identify the practice of design in an activist mode:

- Design Activism is **transdisciplinary** as it embraces diverse modes of expression in different design fields like communication, product, fashion, architecture, etc.
- Design Activism is activated by the designer's critical view on a specific subject matter. Thus, the design process is motivated by the **designer's ethical stance** and has the **purpose to intervene in the socio-cultural sphere** with a transformational aim.

- Design Activism offers a critical view on the project's addressed matter. As such, it is a kind of **counter-narrative discourse** that challenges the user and calls for change.

To better understand what is at stake when we deal with Design Activism, we may look at a project that illustrates the definition proposed by Fuad-Luke and in which visual communication of information plays a central role. As part of the Occupy Wall Street protest movement that rise up back in 2011 [26], the Occupy George [27] project consists on the use of banknotes as a support for the disclosure and diffusion of information about the economic and social inequalities in the U.S. (Fig. 1). This project aims to spread messages that the authors considered relevant for the all society and, as such, it was designed to provide the possibility of accessing templates that allow any citizen to print information on banknotes. In this way, the user becomes an active agent in the communication of these messages.

Thus, Occupy George illustrates clearly the critical stance and the public interventionist approach of its designers in relation to the addressed topic—economic

Fig. 1 Occupy George printed banknotes samples. *Source* http://occupygeorge.com/, last accessed 2022/02/26

and social inequality in the U.S. society. In parallel, the communication process and media used also illustrates the disruptive nature of the project's discourse and, as such, it is an obvious example of Design Activism in action.

3 Information Visualization as Design Activism?

The definitions presented, and its previous discussion, support the assumption that, under certain conditions, Information Visualization can be an expression of Design Activism [28]. To confirm this assumption we need to find compatibilities between Information Visualization practice and the specific attributes of Design Activism, namely the same kind of Motivation, Purpose and Discourse.

For this, we use an interpretive research approach based on the case study method. This methodology allows the analysis and interpretation of different kinds of research objects, identifying their specific characteristics and the contextual relationships that distinguish and define them [29, 30]. With it, we seek to respond to the research main objective, namely to identify and characterize examples of information visualization projects that we can consider as compatible with the main Design Activism attributes. But to achieve that essential goal, we need to address more three specific objectives:

- Identify the reasons that motivate the development of those projects;
- Understand the intentions underlying its design and implementation;
- To characterize the type of discourse that embodies them.

3.1 Argument and Methodology

Based on the literature review, especially on the Design Activism definition proposed by Fuad-Luke [20], the argument that sustains the research process is that Information Visualization projects can be classified as examples of Design Activism if three specific relationships are identifiable.

Motivation—Ethical stance

Activist designer's motivation is based on the recognition of causes (e.g. human rights, natural environment protection, social justice issues, etc.) worth of starting a project. As such, motivation is sustained by the ethical position that determines a critical view on a subject and that ignites the designer's will to visualize it. Thus, in this context, ethics is considered as the individual assumption of a specific moral framework that supports the definition of what is good and wrong, acceptable or unacceptable, etc. [31].

Purpose—Public Intervention

The activist designer assumes the aim of publicly intervene over the addressed subject. As such, design can be a way to promote the disclosure, understanding

and/or critical awareness about a certain phenomenon and the visualization may be the device that is used to achieve that goal. In this research, this kind of public intervention, made through design, is grounded on a conception of political activity that goes beyond the procedures and institutions conventionally considered political [32].

Discourse—Persuasive message

Design Activism's projects defy the established views on certain issues. As such, it is a kind of disruptive design approach that questions the usual state of a situation or the usual development of a process or event. Thus, in such a context, a visualization communicates information that challenges the status quo and persuades the end user by raising awareness, promoting alternative interpretations and suggesting new attitudes and behaviors around the subjects addressed [7, 20].

Based on this argument, the research develops through the selection of the projects to be analysed and the data collection that may allow to do it. According to the specific attributes that distinguish Design Activism the choice of cases is based on four criteria:

Recognition—The selected projects are recognized as paradigmatic examples of information visualization according to the definition previously presented.

Independence—The selection is oriented to self-initiated projects or projects developed in a context which allows a high degree of projectual freedom (e.g. academic).

Accessibility—The chosen projects are available online, also considering the ease of access to complementary information that favors their analysis.

Diversity—The cases address different topics, come from different geographical contexts and are configured with different solutions for visual representation.

Using the case study method, we collect data from three different sources. This is a recommended procedure as it allows the study results to be corroborated through triangulation between sources [30]. The information sources used are:

Observational research—gathering of data based on a controlled interaction between the researcher and the study's object, considering the objectives of the analysis.

Documents analysis—systematic collection of data from related texts and other documents produced and made available by the authors of the projects.

Open interview—conversations carried out with the designers/authors, via e-mail, chat or telephone.

3.2 Case Studies Analysis

According to the research assumption and the argument presented, we select and analyse three information visualization projects:

The Water We Eat, designed by Angela Morelli (2012).

U.S. Gun Deaths, designed by Periscopic (2013).

Um ecossistema político-empresarial, designed by Pedro Miguel Cruz (2013).

The Water We Eat [33] is an infographic story developed by the italian designer Angela Morelli and publicly presented after 2012. This visualization focuses on the concept of virtual water, the amount of water that is implicit in food production and distribution. It was developed following involvement that the designer has been keeping with this theme for several years. The user experience begins with a question—*What if I told: you eat 3496 L of water*—and unfolds in a scroll-down narrative sequence in which the user is confronted with a series of charts and graphics representing the amounts of water consumed in different contexts. The experience culminates with the description of virtual water concept and its explanation applied to beef production. The visual representation supported by graphics, text and image emphasizes the fact that the production of one kilogram of meat implies the consumption of 15,400 L of water. Based on this information, a final appeal is made to change consumption habits that can minimize that water consumption (Fig. 2).

An analysis of this project, supported by the detailed observation of the visualization [33], the reading of related documentation [34] and the researcher's dialogue held with the designer back in 2016, allowed to understand that.

The project was initiated due to a particular involvement and concern with a natural resource that the designer recognizes as essential for humanity. In this sense, the designer recognizes her passion for the subject and assumes moral and ethical reasons for the development of this project.

The infographic narrative is conceived as a communication tool that is used to unravel and diffuse scientific information that the designer considers to be of public interest. Based on this information, the visualization is designed as a means to raise understanding of the issue and spark actions in order to change consumption habits.

The infographic discourse is based on an apparent semantic paradox—*the water we eat*. The use of this argument allows, on the one hand, to reveal the specific content of the information in question (the virtual water incorporated in food) and, on the other hand, constitutes a rhetorical exercise that confronts the users with their knowledge limits. After all, the infographic is an explicit persuasive tool that urges the users to change their attitudes and behavior.

US Gun Deaths [35] is an animated and interactive visualization project developed by the company Periscopic (Portland, U.S.) following the deadly shooting at a school in Sandy Hook, in December 2012. It focuses on the use of firearms in the U.S., showing simultaneously the annual number of victims and also the time of life lost with these deaths. That is, in addition to presenting a cumulative record of deaths resulting from the use of firearms, the visualization also shows an estimate of the number of years of life stolen to these victims (Fig. 3).

The experience begins with the animated representation of an orange arc on a horizontal axis over a black background. Shortly after, a point falls from this arc. A life has ended. From that point on, the arc turns gray and represents the years of life that this person has lost. Moments later, the left end of the horizontal axis changes to a fountain of orange arcs. Tens, hundreds, thousands of arcs turn into gray arcs representing years of lost life. These arcs represent the thousands of victims and the sum of hundreds of thousands of years of life lost, counted simultaneously at the top of the screen. Once the animation is completed, it is possible to access specific
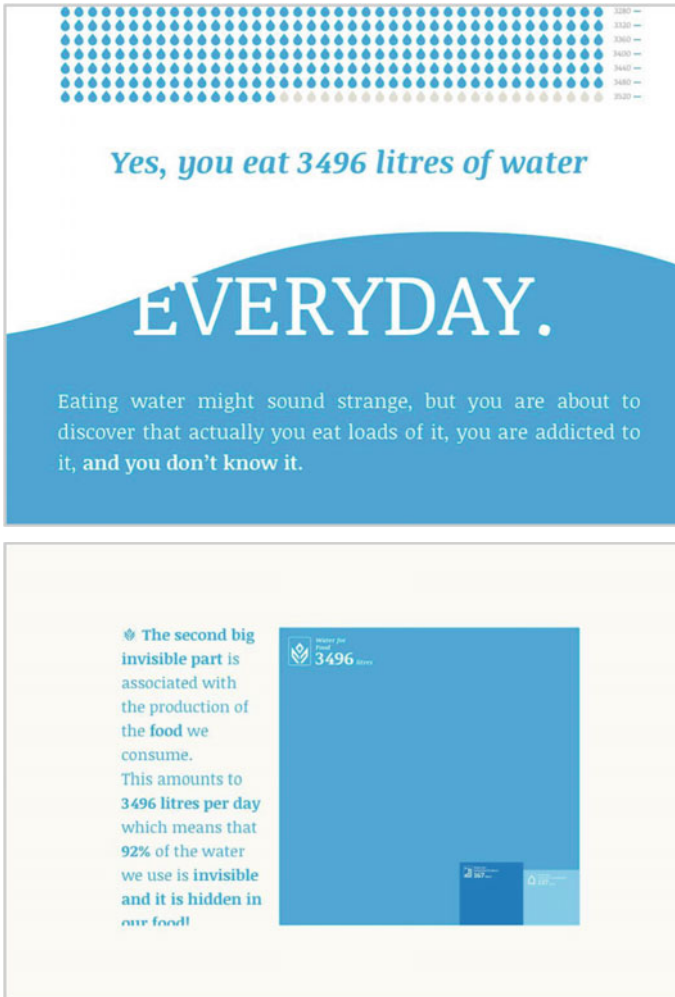
Fig. 2 The Water We Eat website screenshots. *Source* https://thewaterweeat.com, last accessed 2022/02/26

interactive charts that represent the main conclusions and it is possible to filter and explore the data presented.

The analysis applied to this project, based on the observation of the visualization [35], the interpretation of complementary information published by the authors [36] allows us to understand that.

Periscopic's design team describes a personal, emotional and social engagement with the visualization theme. In this sense, the authors assume an ideological and ethical motivation to justify this self-initiated project.
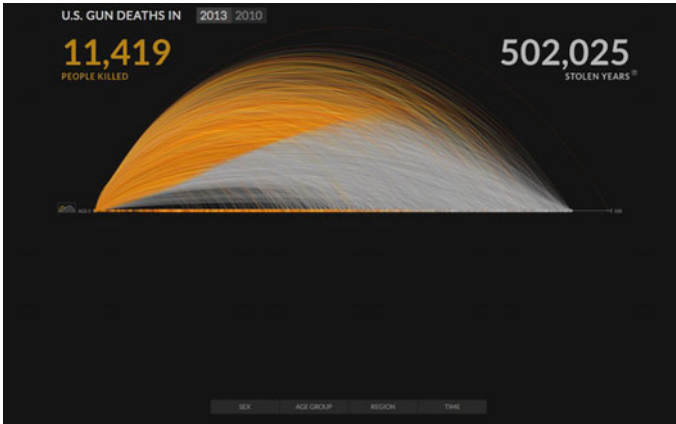
Fig. 3 US Gun Deaths website screenshot. *Source* https://guns.periscopic.com, last accessed 2022/02/26

Given the discussion that this topic has been generating in the U.S., this visualization project aims to raise awareness, change perceptions, promote public discussion and, ultimately, motivate change regarding the use of weapons.

The representation of the time of life lost for each anticipated death offers an alternative view of this issue and suggests an emotional interpretation of the information. As such, it promotes a disruptive engagement with the theme, implicitly calling for reflection and suggesting a new approach of the user over this issue.

Um ecossistema político-empresarial, Portugal 1975–2013 [37] is an interactive visualization that represents the relationships between the political-party and business fields designed by Pedro Miguel Cruz in 2013. The term 'ecosystem' summarizes the recognition of interdependence between the exercise of political functions and the presence in company administrations. In this sense, this project aggregates and represents data on 130 personalities who exercised government functions and respective party affinities, 354 companies and 906 positions held by this different personalities in these same companies.

The user experience begins with an introductory page with the title and a short textual description that allows to understand the interaction interface. Gray circles represent companies and their area is proportional to the number of political figures who have held relevant positions in it. In turn, politicians are represented as insects that surround the companies where they occupy places.

From the top of the page appears a swarm of insects with various shapes and colors that begin to invade the circular structure representative of the business system. The shape of each insect is related to the number of business positions that the represented personality has held and the color symbolizes its partisan affinity. The system comes to life and, in a continuous movement, the insects begin to circle the different circles and move between them, representing the journey of the personalities through the different companies where they are occupying places (Fig. 4).
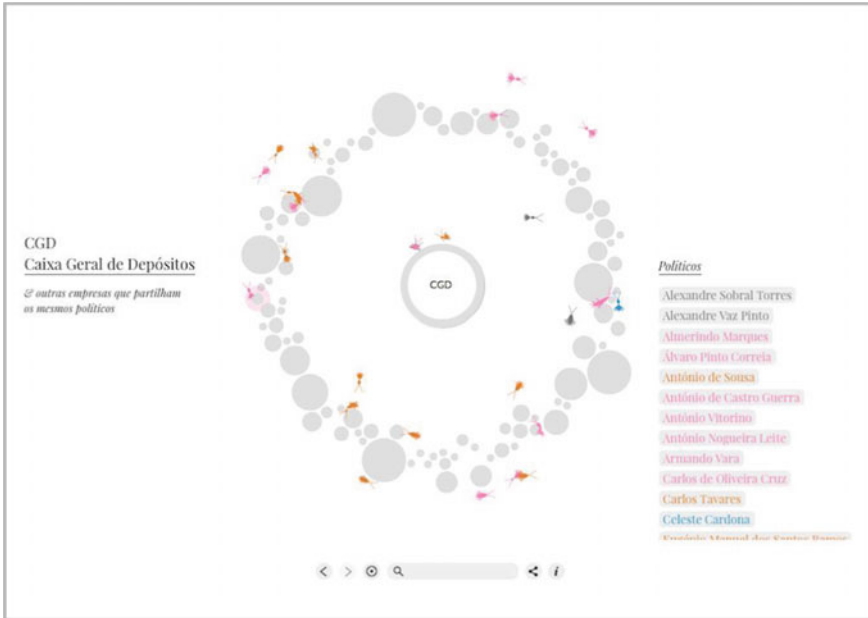
Fig. 4 Um ecossistema político-empresarial, Portugal 1975–2013 website screenshot. *Source* http://pmcruz.com/eco/, last accessed 2022/02/26

By analyzing this project, through direct observation [37], complementary reading on the project development [38, 39] and a talk with the designer, it is possible to conclude that.

Developed in an academic environment, the motivation to design this visualization is directly linked to engagement of the designer with the theme – promiscuous relations between politics and business. As such, the designer assumes that this is an issue that worth more informative and visual attention, which reveals his ethical and ideological motivation.

The designer assumes that the purpose of this visualization is to promote awareness on this specific issue and complement the discussion that this theme raises in society and in portuguese media.

The use of an ecosystem metaphor, in which political personalities are characterized as insects that explore the companies, offers the visualization a satirical tone. In this sense, this project takes on a critical approach to the way this question affects portuguese society and implicitly suggests that people and institutions shall behave differently over this issue.

3.3 Research Results

The results obtained with the analysis of the three mentioned projects support the assumption and the argument that determine this research—Information Visualization can be identified as an expression of Design Activism because it was possible to identify the characteristic attributes of Design Activism.

Indeed, the three projects are, explicitly or implicitly, motivated by the ethical position of their designers in the face of varied issues linked to the environment, society or politics. Simultaneously, the three projects can be identified as public interventions that contribute to unraveling information considered important, raising collective awareness and promoting an informed public discussion of the issues addressed. Finally, although covering different subjects and using different visualization strategies, the three projects have in common a discourse that, explicitly or implicitly, challenges the visualization's user to take a stance and appeals for a change over the addressed issues.

Based on these results we propose a conceptual model that describes the practice of Information Visualization as an expression of Design Activism (Fig. 5).

Visactivism can be defined as the practice of Information Visualization that crosses Design Activism by sharing parallel motivations, similar purposes and the same type of discourse. As demonstrated, an Information Visualization project can be, explicitly or implicitly, motivated by the designer's ethical stance over a certain issue that is identified as a problem worth to be responded. As a consequence of that ethical call to action, a visualization can be designed to address the importance of that specific problem, disclose less known data, raise awareness or promote a needed societal debate. As such, visualization is a public intervention that can be politically grounded. At the same time, this intervention is, explicitly or implicitly, a persuasive discourse that defies the most conventional views and challenges our way of dealing with different environmental, societal or political issues.

Fig. 5 Visactivism—a conceptual model

INFORMATION VISUALIZATION

Motivation   Purpose   Discourse

Designer's   Public   Persuasive
Ethical Stance   Intervention   Message

VISACTIVISM
Information Visualization as Design Activism
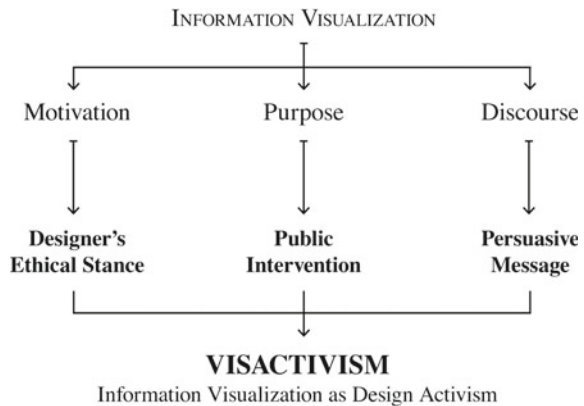
4　Conclusions

This research explored the possible intersection between Information Visualization and Design Activism. By case studying three projects, it was possible to confirm the assumption that a visualization can be an expression of design practiced in an activist mode. Indeed, a visualization project may have the designer's ethical motivation, the public intervention purpose and the persuasive discourse that are identifiable as specific attributes of Design Activism.

Thus, Visactivism identifies a specific design practice domain that intersects Information Visualization and Design Activism. This conceptual model proposal may allow a critical assessment and classification of Information Visualization in the broader Design field and shall be considered a contribution to nurturing the theoretical ground of Design Activism.

The Visactivism conceptual model is the result of an exploratory research and, as such, is open to further developments and contributions. Considering the limited scope of the cases studied and the lack of an external validation instrument that would strengthen the results, future work can be directed to an extended case study with additional research validation options and instruments.

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Digital Design Branding

Capitalist Visuality: Branding, Architecture, and Its Visual Reproduction. A Case Study in the City of Porto

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Abstract This chapter examines the promotional image of the city of Porto, created and disseminated in the last decades, as a means through which core capitalist values, objectives and operative logic are disseminated and naturalized in public space. Mirzoeff's conceptualization of visuality, as the aesthetic means through which dominant systems seek to present their legitimacy as self-evident, informs our examination of branding, architecture, and its visual reproduction, as discursive practices employed in the deployment of what we will designate as a capitalist visuality. Local tradition and cosmopolitan modernity are identified as the two main concepts in the promotional strategy designed to enhance the city's appeal, which representation relies to a large extent on architectural aesthetics, namely vernacular heritage, and international architectural icons. The chapter analyzes the recurrence of these concepts in branding, promotional imagery, and architectural management.

Keyword Capitalist visuality · Place branding · Architecture · Porto

1 Context

In 1996 the historic center of the city of Porto was recognized by Unesco as a World Heritage Site. The glaring physical degradation of the city center was then a matter of concern. Residents' numbers had been decreasing for decades. In 2001 the city was nominated European Capital of Culture. A major urban regeneration plan was conducted in the context of this event. In 2005 the recently created Porto Vivo—Society for Urban Rehabilitation launches a masterplan for the rehabilitation of the

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city center, marking a turn towards a new generation of urban rehabilitation policies, based on principles of competitive urbanism, that prioritizes the development of tourism and attraction of private investment [14]. In 2005 the concert venue Casa da Música, designed by Rem Khoolhaas, was inaugurated, bringing a prestigious piece of architecture to the city. In 2007 the social neighborhood S. Vicente de Paulo was demolished. 220 residents were displaced, despite manifest resistance. In 2008, the economic crisis was countered with the reinforcement of national and municipal measures to attract foreign investment [10]. In 2011 the first of five towers of the social housing complex known as Torres do Aleixo was imploded. The mayor watched from a boat in the river in the company of 100 guests, while enraged residents were forced to disperse with pepper gas. In 2012 the city was elected Best European Destination for the first time. In the same year, over a thousand citizens manifest against the eviction of a self-managed cultural collective from a deactivated school and reoccupy the building. The collective was re-evicted soon after. In 2013, a high segment residential project on the site of the former Aleixo towers is approved by the City Council. In 2014 the newly elected municipal executive launches the "Porto." brand. 600 billboards present the brand to the city, while applications in light rail vehicles carry it to the surrounding regions. In 2005, due to the increasing affluence of tourists, the historic library Lello started to charge entrance fees. In 2017 the local airport registers over 5 million arrivals, which represents a growth rate of over 140% in one decade. [7]. The ratio between accommodation capacity and residents reaches 85.4 per 1000 residents. Housing prices almost doubled in the previous 5 years [10]. In 2018, a 40 million euros privately funded project for a new business, cultural and civic center designed by Kengo Kuma is announced by the City Council as the new Casa da Música.[1] In 2019 the Council presents a project for the construction of a housing project comprising affordable as well as market priced housing, at the site of former S. Vicente de Paulo neighborhood. Former residents manifest their disagreement that such housing prices are considered affordable and reclaim their right to inhabit the place. By the end of that year, after unfruitful negotiations, the small kiosk that hosted the Worst Tours walking-tours-agency, known for being critical of the development model adopted by the City Council, was demolished. In 2020 the Covid pandemic forced the suspension of tourism for several months causing a considerable number of accommodation facilities and restaurants to shut down. The same year, a group of citizens delivered a petition to the National Assembly against the construction of a new shopping mall at the site of a deactivated railway station, proposing instead the creation of a public garden and the conservation of the station's remaining building. The government and the local administration both state the decision to build the mall is irrevocable. In the local elections of 2021, the number of registered voters in the historic center is 25% lower than it was in 2005.[2] 25% of the housing units in this

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[1] http://staging.goporto.pt/noticias/arquiteto-japones-kengo-kuma-e-o-nome-que-liga-o-olimpico-de-toquio-ao-matadouro-de-campanha.

[2] Calculated according to official statistics from the Ministry of Internal Administration.

Fig. 1 Clockwise form upper left: site of the demolished S. Vicente de Paulo social neighborhood © Ana Miriam; promotional image depicting the historic center [*Source* europeanbestdestinations.com]; construction of the new Lapa Renaissance Hotel © Ana Miriam; building wrap displaying the "Porto." brand © Ana Miriam; site of the demolished Worst Tours kiosk © Ana Miriam; advertising for new luxury apartments at the river front [*Source* idealista.pt]

region of the city are unoccupied.[3] A new six storey, 14,000 m², high range hotel is emerging in front of Monte da Lapa, a small hill covered by small modest houses. There is presently no visible trace of the Aleixo Towers in their former grounds. The site of the former Worst Tours' Kiosk remains empty. Housing prices continue to rise (Fig. 1).

The above events evince the accelerated transformation process that has been taking place in the city of Porto for the last decades and the contrasting realities and narratives that coexist in the city, on different levels of visibility. Watching the spectacle of capitalist development transform the stage of their lives, how can citizens make emancipated sense of what they see, in relation to what they are told and what they experience?

This chapter addresses this question by examining the promotional image of the city, created and projected in the last decades, as a means through which core capitalist values, objectives and operative logic are disseminated and naturalized in public space. Mirzoeff's conceptualizations of visuality, as the aesthetic means through which "domination imposes the sensible evidence of its legitimacy" and countervisuality, as the right to produce autonomous sense of the reality imposed by visuality [11], inform our examination of branding, architecture, and its visual reproduction, as discursive practices employed in the deployment of what we will designate as a capitalist visuality.

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[3] Data retrieved from the Censos 2021. https://censos.ine.pt/xportal/xmain?xlang=pt&xpgid=censos21_dados&xpid=CENSOS21

2 The "Porto." Brand: Local Tradition and "Cosmopolitan Modernity"

Mirzoeff's conceptualization of visuality examines visual culture as a medium for the dissemination and legitimization of power, as well as for its disruption. Building on Rancière's "distribution of the sensible" [16], visuality designates the aesthetic means through which dominant systems seek to present the legitimacy of their world views as self-evident. It is not a matter of mere perception, but also of imagination, a dimension that Rancière also alludes to when he asserts the reconfiguration of possibility as a defining characteristic of political acts. As such, visuality and countervisuality involve perceptions of current situations, of the inscription of the past in the present, as well as incursions into possible futures.

As visuality works to impose a given reality as ineluctable, "counter-visuality claims the right to make autonomous sense of reality, while at the same time proposing an alternative" [11]. The exercise of what Mirzoeff designates as "the right to look" is a subversive act, political in the sense proposed by Rancière. This chapter is constituted as an attempt at one such exercise.

The effect of place branding as an instrument of visualization of the capitalist system is twofold: it reproduces and embodies the hegemonic capitalist logic that views places as products that must be enhanced through promotional strategies, in order to perform successfully in a highly competitive global market; simultaneously, it seeks to establish and naturalize a vision of the city that matches the idealized product. As Sorkin has put it: branding "entails the sale of both advertising and product" [23]. Naturalization plays a crucial role in the pursuit of both effects.

Mirzoeff identifies naturalization as a defining operation of visuality complexes. It is the means through which its conceptualizations are made to seem right, through which it seeks to ensure consent by presenting them as self-evident. Visuality, in Mirzoeff's terms, is much an issue of inevitability, of things presented as incontestable facts. As we have previously argued [17], place branding has found a very effective naturalization mechanism in the equation of the expressions *place brand* and *place identity*. "While the word branding is explicit on the constructed nature of its products, and generally connoted with profit, the word identity is associated with intrinsic, essential characteristics" [17]. Thus, presenting a brand as something intrinsic to a place, naturalizes a construct, intentionally confounding places with their branded images. Place branding is likely one the most favorable marketing fields for promoting the idea that "brand is simply the equivalent of culture and its styles of inventing identity" [23].

The "Porto." brand, implemented by the City Council in 2014, is a very evident example of a place brand's strategy to achieve validation through naturalization. The central feature of its graphic identity, designed by Eduardo Aires and White Studio, is its logo, displaying the city's name in a bold, blue typeface, followed by a full stop (Fig. 2). This simplicity is meant to be read as blunt: "Porto, period. It is unquestionable, unavoidable, incomparable (…) Its affirmation is not external, it is

Fig. 2 'Porto.' graphic identity | © Eduardo Aires/White Studio

intrinsic to Porto" [1]. The brand's manual provides many other examples of intended confusion between the city's intrinsic identity and the brand [17].

While external communication was assumed by the City Council as the priority of the brand's creation [4], a lot of effort is also put in fostering residents' identification with the product being developed. For the product to fully work, citizens must buy it as well. Identification in turn favors public consent of the vision and development strategy pursued by the local administration. In this way, the city brand works both as advertising and propaganda.

The promotional strategy of the "Porto." brand is disseminated through formal means, namely through the brand's manual [2], and endlessly replicated by the diverse industries and actors that, on different scales, live on the city's profitability. It is anchored on a narrative on the city's past, an understanding of its present and a vision of its future, from which two contrasting concepts stand out: local tradition and "cosmopolitan modernity".[4] While presented as core characteristics of the city's identity, these are, above all, its best commercial assets.

The brand's graphic identity highlights these two assets, by depicting traditional local elements, using a contemporary, international graphic language. This widely adopted design formula has nevertheless been producing paradoxical homogeneity among place brands at a global level, contradicting the very purpose of place identities (Porto Pelo Porto [13]). While the content is specific, the form is generic. On the other hand, this strategy seems to offer the tourist a comfortable balance between exotism and familiarity [9], providing a tamed translation of the city's potentially challenging alterity, into easily recognizable global references, suitable for rapid touristic consumption.[5]

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[4] This last expression was employed by the current Mayor in the manual of the "Porto." Brand [2].

[5] For a detailed discussion on this subject see [17].

Fig. 3 Building wrap. Municipal vehicle © Ana Miriam

The brand's rhetoric is made visible in public space—both physical and virtual—through overwhelming ubiquity and repetition. The brand's sudden and spectacular appearance in 2014, depicted in 600 billboards, travelling the city in public transports, labelling municipal buildings and vehicles, building sites, and municipal workers, set the tone for what remains a strategy marked by a blatant concern with visibility. Through different scales of placement, from gigantic building wraps to labels on street dustbins, the brand's presence is both imponent and pervasive (Fig. 3).

Although directly impacted, the common citizen is a mere spectator of this branding operation. In a typical exercise of visuality, the City Council asserts "that exclusive claim to be able to look" [11], the prerogative of stating its own reading of matters as reality. By projecting a vision of the city that has more to do with the values of global capitalism than local idiosyncrasies, it affords legitimization to a development model based on a capitalist logic that equates the concepts of economic growth with public prosperity, thus establishing it as self-evident objective.

Yet a semblance of participation is advisable. It was provided by an inaugural event in which citizens were invited to draw new elements for the icon network that surrounds the brand's logo, some of which were included in the brand's repertoire. More than an actual opportunity for participation, this late involvement of residents was a means to validate the brand [4].

3 Architecture and Capitalist Visuality

The deployment of a capitalist visuality and the dissemination of the narrative that promotes the city of Porto is achieved through a diversity of instruments which concur to effectively transform the city into the idealized product and naturalize a commercial approach to its development. Thus, the brand's representation of the city, at once reflects and supports urban interventions, which in turn progressively confirm the city's branded image, through selective rehabilitation and investment in the production of particular architectural aesthetics, operating a dynamic of mutual legitimization. As remarked by the authors of project "Porto pelo Porto", invited to present a proposal for the city's graphic identity: "(…) which Porto we choose

Fig. 4 Images of Porto's historic center local displayed in local businesses © Ana Miriam
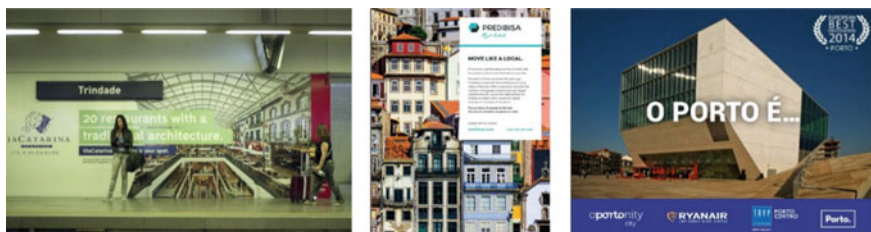
Fig. 5 Promotional imagery: Advertising for shopping mall at a subway station: "20 restaurants with a traditional architecture" © Ana Miriam. Real estate advertising [*Source*: Invest Porto booklet] Touristic promotional imagery [*Source*: Visit Porto Facebook profile]

to privilege and project, are decisions that contaminate the present as well as the dreamed city. We cannot separate representation and vision of the city. The first implies the second" (Porto Pelo Porto [13]).[6]

This synergy relies on yet another crucial instrument: visual reproduction. Images expand the visibility of iconic urban views at a global level and replicate it in every corner of the city (Fig. 4). Through repetition, these images populate the collective imaginary of residents, and prefigure the tourist gaze, before it meets the real city [21]. Given the relevance of tourism in the city's economy, promotional imagery is to a large extent targeted at tourists, but also at investors and prospective new residents, and finally at local consumers. As economy is the city's main drive asset, its promotional image is the dominant tune.

An analysis of promotional images for the city of Porto, comprising communication and advertising issued by different agents, including the City Council, tourism promoters, real estate agencies and local businesses, reveals a recurrent display of built heritage, often punctuated with contemporary architectural icons. The promotional rhetoric that sets local tradition and "cosmopolitan modernity" as the city's highlights relies to a large extent on architectural aesthetics: vernacular heritage on one side, and international contemporary architecture on the other (Fig. 5). As a

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[6] Translation by the authors.

major asset of the city as a product, architecture is part of the product, but it is also part of the narrative. It is a referent but also a signifier.

Promotional images thus confirm the selection operation taking place on the physical level, with greater efficiency, as the selection performed by images effectively excludes all that is not displayed. The management of the visibility of the city's architecture thus operated, on the physical plane as in the plane of images, is part of a strategy pursued by the local administration comprising the "constitution of a cultural and iconographic scenery"[15],[7] favorable to the attraction of tourism, investment and new residents.

As a result of Unesco's declaration of Porto's historic centre as a "world heritage" site, the traditional architecture of its medieval core has become the city's trademark, the object of increasing efforts of conservation and refurbishment and massive visual reproduction. In the book that celebrates the 20th anniversary of Unesco's declaration, makes a comprehensive analysis of the role of heritage discourse as a cultural, economic and political device, noting how the historic city was endowed with a discursive construction swaying between the urgency to protect and preserve and the opportunity for making business, between the sacralization and commodification of heritage [6].

Various authors have examined the relationships between the cultural role and the commodification of heritage at a broader level. Sola Morales [21] analyzed the heritage processes through which objects, such as architectural constructions, are elevated to the status of works of art and historic documents, entering a specific consumption system, as well as their conversion into images that become the basis of history, aesthetic experience, and local identity, and come to represent concepts as progress or cosmopolitanism. His analysis builds on Sorkin's conceptualization of the theme park to address the sense of simulation pervading in historic centers, and Debord's examination of the relationship between the society of spectacle and capitalist commodification.

As a valuing system, heritage discourse sets a hierarchy upon cultural objects, and is strongly entwined with political and economic rhetoric. Guillaume [8] argues that: "They operate by sorting, differential destruction, selection. They rehabilitate, transform, reuse. All in all, they hierarchize, order and stage elements that are useful to them for the management of the present, to acclimatize the future. Heritage is made educational, touristic, a setting of economic investment and experimentation of advanced techniques."[8]

In a city as old as Porto,[9] the management of the existing built estate is a crucial rhetorical arena. Besides its protagonism in the promotional strategy designed to enhance the city's appeal, heritage is also an effective resource for the creation of identity narratives that play on the citizens' sense of belonging and collective pride, crucial factors in the naturalization of the city's promotional image. This instrumentalization of architectural heritage is nothing new: not so long ago, we may

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[7] Translation by the authors.

[8] Translation by the authors.

[9] The city's oldest buildings date from the twelfth century.

recall how the conceptualization and dissemination of the style of the "Portuguese House"[10] was employed to consolidate a certain construction of Portuguese identity during a nationalist dictatorship grasping at colonial power and fighting modernity.

The touristic rhetoric of authenticity finds particularly fertile ground in the city of Porto, where a historic rivalry with a capital seen as sophisticated has strengthened a tradition of direct speech, and blunt character. Not only does it fulfil what seems to be a global touristic demand for authenticity, it meets local narratives, providing a process of identification that often favors uncritical approval. Hence the success of "Porto period", through the instrumentalization of local idiosyncrasies, in favor of legitimizing the commodification of local culture.

On the other end of an architectural spectrum, in which visibility is concentrated in the extremes, we find contemporary architectural icons. These have become indispensable signs of innovation and wealth for cities aiming to stand out in a global competition. Their role in the "capitalist quest to transform places and cities into marketable brands" [24] is widely acknowledged and explored by governments and local administrations. Examinations of the role of iconic buildings in making capitalist hegemony visible demonstrate an instance of capitalist visuality. As remarked by Sklair [18], capitalist corporations and their political and professional allies dominate the construction of built environment, a position that allows them to inscribe their own interests in public space. In "The Icon Project" Sklair argues that iconic architecture is an important instrument to "create and solidify capitalist hegemony" at a global level [19].

In his critique of the centrality that business and branding has assumed in contemporary architecture, [23] Sorkin argues that the brands of renowned architects' provide "high-cultural legitimatization" to corporate powers, noting that branding reduces architecture's meanings to mere advertising. He further remarks that in the post-modern era, the "aesthetic supplement" comes to "embrace the criteria and symbols of global capital."

The dissemination of this visuality, beyond public space, relies in the massive reproduction enabled by digital images. If photography was already a fundamental vector of architectural commodification since the onset of modernism, this dynamic has become ever more relevant as digital photography vertiginously expanded the circulation of architectural images, into the new virtual public space. The digital revolution has also enabled the rise of architectural renderings, increasingly difficult to distinguish from "actual photographs" [12]. They are "views of an idealized future" that push "mediation a step further" as testified by the architects of the Urban Think Tank [3].

In the city of Porto, the function of representing the city's "cosmopolitan modernity" in promotional imagery, has fallen largely upon Rem Koolhaas' Casa da Música, built on the occasion of the city's nomination as European Capital of Culture in 2001. While other buildings by celebrated architects exist in the city, namely by two local Pritzker prize recipients—Siza Vieira and Souto de Moura—they do not play

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[10] The concept of the Portuguese House was developed by Raul Lino in his 1929 book "A Casa Portuguesa".

Fig. 6 Rendering of the future Business, Cultural and Civic Center, by Kengo Kuma

a prominent role in the promotional iconography. Their aesthetics seem to lack the spectacular character that is required to produce iconic images. The sobriety and integration of these buildings in their locations seems to compromise iconic potential.[11] Khoollas, in turn, is one the four designers identified by Sklair as major producers of iconic architecture.

In the near future, the new business, cultural and civic centre by Kengo Kuma, announced as "the new Casa da Música", will increase the city's ratio of "cosmopolitan modernity" per local tradition. Its "unique visual impact" is being explored well before its construction, which should begin in 2024, through the dissemination of renderings. (Fig. 6)[12] This is a key project for the current administration, marking its development strategy and reinforcing the city image it aims to project, which is to mirror the executive's own image as a cosmopolitan, liberal administration. This demonstrates awareness and operationalization of the fact that "the selection of iconic foreign architects for prestigious national and urban projects has become a prominent feature of capitalist globalization" [18].

Common citizens are, here again, spectators to urban processes that transform their environment. Residents are symbolically invited to take part in the discussion of fully developed projects and plans, only to the extent to which they do not obstruct, but conveniently validate them. An example of such pro forma procedures is the call to the public discussion of the recent revision of Porto's Municipal Master Plan. This type of consultation occurs at the final stage of the process, in which research has

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[11] See for example Siza Vieira's Serralves Museum and Souto de Moura's Casa das Artes.

[12] https://www.porto.pt/pt/noticia/quem-e-kengo-kuma-veja-as-imagens-impressionantes-do-projeto-que-fez-para-o-matadouro-que-ja-tem-luz-verde-para-avancar.

Fig. 7 Representation of the future Monte da Bela housing project

demonstrated there is less opportunity to effectively influence the final document, since at that moment only specific and often technical issues can be addressed and not general principles or directions [5]. According to the report on the process of public discussion,[13] only 14% of the contributions were fully integrated in the final document.

The lack of citizen participation here demonstrated in the instances of branding and urban development, is revealing of the domination of public space as a discursive scene by the alliance between political power and major corporations, that has become typical of western urban environments. Meanwhile, groups of citizens spontaneously contest municipal plans that from their perspective, ignore their needs and expectations and often violently infringe elementary principles of democracy and justice. Such is the case of the former residents of Monte da Bela, scattered across different locations after their neighborhood was demolished over justifications they did not comprehend.[14] Fifteen years later, they reclaim the right to be included in a new residential project, which is to be built at the same location, overseeing the river[15] (Fig. 7). However, despite integrating a municipal strategy to provide affordable housing, this new housing project is not accessible to their revenues. This is a

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[13] https://pdm.cm-porto.pt/documentacao/

[14] https://www.publico.pt/2007/12/06/jornal/camara-do-porto-comecou-a-demolir-35-casas-do-bairro-de-sao-vicente-de-paulo-240318.

[15] https://rr.sapo.pt/fotoreportagem/pais/2021/06/18/catorze-anos-depois-de-ter-sido-obrigado-a-sair-telmo-ainda-sonha-que-mora-no-bairro-de-sao-vicente-paulo/242958/.

very concrete example that indeed, "the effort to reclaim the city is the struggle of democracy itself" [22].

Besides tradition and "cosmopolitan modernity", ordinary life proceeds in the functional austerity of generic apartment blocks, in the unclassifiable creativity of informal housing, in the raw aesthetics of scarcity, in expectant *terrain-vagues* [20] and abandoned buildings appropriated by autonomous agents. What image of the city can be composed from these other realities? How long before the marginal vitality that emanates from some of these spaces is neutralized by the ever-expanding co-optation that constitutes the defense mechanism of branding, by a system of which, it has been said, there is no outside (Koolhas, as cited in [23]). Can they explicitly be constituted as alternatives without exposing themselves to such mechanisms, or is their potential of subversion better kept underground?

The research and production of visual means that can foster alternative visions of the past, present and future of places, and challenge the established role distribution that prevents common citizens from actively participating in the construction of their environments is, we argue, an important path in the continuous endeavor of reimagining power and possibility, that is the core of countervisuality.

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A Sense of Kyoto Through Advertising: A Case Study on How Outdoor Advertising Can Support Local Identity

Ana Seixosa and **Maria Cadarso**

Abstract Throughout its history, Kyoto has been considered a well-designed city, with drawings of its natural and urban landscape reproduced in a myriad of everyday objects. To protect this panorama amid the modernization of the city and the growing number of disruptive outdoor advertisements, brought about by globalization and economic progress, policies of landscape preservation and city planning have developed severe restrictions, holding much higher standards than any other city in Japan. Using Kyoto as a model city, this study explores the benefits of a greater contribution from brands in the dissemination of the intrinsic values held by a given place through its outdoor advertising. To establish a basis capable of assessing the importance of quantitative and qualitative variations in advertising, the current Japanese sociological, cultural, and aesthetic situation was analyzed. Through a field study based on visual research, a sample composed of 180 advertising objects was collected in Kyoto and examined in three sequential phases: descriptive analysis, content analysis, and interpretive analysis. The results show a cultural and aesthetic preference in the outdoor advertising of Kyoto which could be explored by brands to support local identity, as well as establish a more effective, meaningful relationship with the city's inhabitants.

Keywords Kyoto · Local identity · Outdoor advertising · Cultural preferences · Aesthetic preferences

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1 Brief Overview of Kyoto City

1.1 From Edo Period Onwards

Although the country's capital for more than a thousand years until 1868, Kyoto had said title overthrown during the feudal period (1603–1868), with the establishment of the central government in *Edo* (present-day Tokyo) by the *shōgun* Tokugawa Ieyasu (1543–1616) [1]. Notwithstanding, Kyoto remained the center of imperial power—although with no political authority—as well as an academic and cultural center supported by the noble society of the court. These members of the imperial court, although financially dependent on the shōgun, would continue to support the fine arts in the city, employing the most gifted artisans in Kyoto to supply their needs for refined pieces [2], and thus, the manufacture of various luxury items led the local economy to flourish in the direction of traditional industries such as *nishijin-ori*, pottery, ceramics and bronze wares [3]. In the second half of the Edo period, the city known for its temples and shrines had a population of almost 400,000 inhabitants who identified with the elegance and refinement befitting of the imperial court [2]. The art produced in Kyoto at the time was also less limited than the art produced in Edo, the latter being restricted to a set of expressions due to its direct contact with the shōgun regime [4]. Consequently, and as attested by Okakura, several academics, scholars, and thinkers considered Kyoto their refuge, developing new schools and art forms there that would eventually serve as a fulcrum for the Meiji restoration.

Nowadays, Kyoto's cultural heritage is one of the country's main assets, which is why the government, as well as the city's inhabitants, remain committed in maintaining the same traditional atmosphere, introducing, to this end, radical reforms [5, 6]. According to Sugimoto, Kyoto inhabitants represent the culture of western Japan in an insightful way; enjoying interpersonal relationships influenced by principles of non-intervention, partial commitment, and mutual freedom, thus developing a more refined and modern style of group dynamics than the—historically hierarchical—dynamics held by Tokyo inhabitants [6].

1.2 A Government-Designated City

Throughout its history, Japan has selected a certain group of landscapes containing aesthetic appreciations, designating them as scenic places [7]. Regarding the scenery of Kyoto prefecture, since the period of state of war in Japan, *Muromachi* period (1336–1573), drawings of its landscape have become particularly popular in the country, encouraging the practice of visiting shrines and temples for its sightseeing purposes among the people [3]. Over more recent years, the modernization of the city and disruptive advertising objects have slowly transformed this previously esteemed landscape, causing landscape planning and preservation policies to acquire greater

importance to deal with the expansion of the urban area and the increase of the commercial activities [3, 5].

The fear of losing its cultural heritage in the near future due to the irregular urbanization of the city, led Kyoto to establish the Council on Landscape Formation of Kyoto Shining Forever [3]. Following new recommendations from this council, in 2007, the city of Kyoto created a New Landscape Policy where, among other projects, was the implementation of stricter regulations on outdoor advertising. Thus, to existing restrictions, ordinances such as: the use of a more restricted color palette (prohibiting the use of bright red and yellow tones as base colors as it is considered disruptive to the immediate scenario); the standardization of the format of lateral signboards of shops; the removal of twinkling lights and inappropriate mobile advertising; and the removal of advertising panels from the top of buildings were added [5]. This review aimed to create agreement in relation to the local characteristics of height and design of buildings, especially regarding the urban attributes of the *kyo-machiya* (traditional townhouses), which carry great cultural value. In addition, the city created incentives related to the design of advertising objects that can contribute to making each of its districts more attractive. Thus, advertisements with a historical design, and intended for the well-being of the community, favored a relaxation of the restrictions, particularly in terms of dimension and height [5].

This last point is of particular importance, considering that a greater focus on the appreciation of the scenic landscape may cause a neglect for the everyday environment, as well as the experience of the local inhabitants. According to Saito, the disregard for such variables may result in an impoverishment, both aesthetic and ecological, of the everyday landscape that, ultimately, will affect society on a deeper, more constant level than the distant scenic places [7].

2 Problem Definition

Pondering the restrictions on outdoor advertising established by the Kyoto government, we intend to verify if they are beneficial, not only in protecting Kyoto's landscape but also in disseminating its identity and ensuring community well-being.

Regarding outdoor advertising as an integral part of the urban landscape, we hope to demonstrate that its ability to adapt and recognize different socio-cultural contexts will reinforce the local identity and a *sense of place* in Kyoto. Thus, this investigation explores the adaptation of outdoor advertising based on the possibility of its consideration—in its various languages—of the local identity, aiming to reveal if current outdoor advertisements in Kyoto present specific cultural and aesthetic preferences.

3   Contextual Framework

To ensue this investigation, we deal with the essential themes to analyze the reality of Japanese society and the way in which advertising has adapted to its changes over the years. In this sense, the necessary information for the construction of the contextual framework of this study was organized into four study areas: sociological variations; cultural variations; aesthetic variations; and the History of advertising in Japan. The contribution presented here is taken from an investigation carried out during a master's dissertation where an extensive literature review was produced, and which explored outdoor advertising tendencies in the cities of Kyoto, Osaka, and Tokyo. For the purposes of contextualization for this paper, and an ongoing Ph.D. investigation, only the most relevant findings related to the city of Kyoto will be analyzed, where we develop on the initial data, now centered on Kyoto city and its community.

3.1   The Japanese Society

Reflecting on the external image of Japanese society, Sugimoto observed that the lifestyles and values of certain groups, with greater access to the mass media and notoriety, acquired a disproportionately high level of visibility in relation to the rest of the population [6]. Such a tendency implied that Japanese society was often viewed from a generic perspective, based on a biased sample of the middle class as representative of the whole. Likewise, *nihonjinron* (theories of "Japaneseness"), a discourse frequently utilized in books and academic studies on the country, persisted as the paradigm that considered Japan the bearer of a single and homogeneous society [6]. Just as stated by Sugimoto, this idea can be contradicted upon closer observations, revealing a much more diverse society than the stereotype suggests.

Sociological Variations. The Japanese archipelago, made up of four main islands (*Hokkaidō, Honshū, Shikoku, and Kyūshū*) and about seven thousand smaller islands, has, currently, a population of around 125 million people. If we regard Japan as a conglomerate of different provinces, divided into regional blocs, it will not come as a surprise that people will present distinct lifestyles according to the region where they live. As such, topics such as eating habits, type of housing, language, and mentality are some of the varying characteristics attributed not only to generational differences, but also regional ones [6].

Furthermore, for much of history, because of these spatial and cultural variations, as well as a need for expanding their respective authority, a scenario of competitiveness between the *Kantō* region (an area east of Honshū which includes the Great Tokyo area) and the *Kansai* region (an area west of Honshū which includes the Osaka and Kyoto prefectures) could be observed [6]. This rivalry persisted until today, as Sugimoto described two distinct Japanese societies: the first, structured vertically, where hierarchical superiority dominates sectors such as work, education,

and household (mostly observed in the Kantō region); and the second, more horizontally organized and egalitarian, where women enjoy a higher social status (observed in the Kansai region) [6].

Cultural Variations. Such as the culture of other complex societies, Japanese society comprises a multitude of diverse subcultures which can be organized into three categories: folk culture; alternative culture; and mass culture.

Folk Culture. This type of popular culture is established in the day-to-day life of the population, i.e., it is constantly being formatted and its content modified from place to place and as the years go by. Thus, folk culture has a great dependence on its inhabitants' historical memory, and it is the reason for regionally diverse behaviors and traditions such as festivals, folk songs, local dances, etc. [6]. Sugimoto suggested three Japanese emic terms as fundamental to understanding the folk culture of the Japanese, namely: *hare*, *ke* and *kegare*. Hare will represent occasions and events where formal and festive feelings prevail and where people dress up and enjoy delicacies considered exclusive to "hare events". In contrast, ke will relate to what is routine and conventional, its triviality giving rise to the concept of kegare, in which the vitality of events is lost. How we view opposing types as hare and ke or hare and kegare, is said to determine the characteristics of a particular society [6].

Alternative Culture. Characterized by forms of mass dissent in relation to the established order. This category of culture will reflect the displeasure and grievances of parts of society and the desire to rebel and challenge the cultural status quo of some groups [6]. Thus, alternative culture challenges the scenarios and visions constituted by mass culture and folk culture, threatening the established patterns, however, it can also be indirect, and not necessarily political. Some examples are the *mini-komi* (mini communications), such as community newsletters and magazines; counterculture events and performances; new religions; and the rise of socially deprived groups for their defiance of authority, sexual orientation or political beliefs [6]. As pointed out by Sugimoto, contemporary Japanese culture is rife with examples of alternative culture, that today are exposed and at risk of being lumped together with folk culture or mass culture.

Mass Culture. Mainly spread through mass media, mass culture will be dependent on its value in the market, remaining relevant as long as it is consumed by a large number of people. Consequently, mass culture is consumer-oriented, where its viability is directly subordinated to people's willingness to consume, or continue to consume, its contents. Once the public's disinterest is apparent, mass culture must transform itself, as is often the case in the music and fashion industry, which, are constantly changing [6]. Sugimoto also described the fluidity and variability of forms and styles as a vehicle for the proliferation of mass culture, indicating four phenomena that achieved worldwide popularity: *manga*; *pachinko*; *karaoke*; and love hotels, along with other love industry products. More recently, other expressions of Japanese popular culture such as J-pop, dramas, cinema, live actions, and entertainment programs on Japanese television have been increasingly consumed in mass and other non-Japanese audiences [8]. The diversity within the mass culture phenomena elements themselves (e.g., in the J-pop industry, where there is a vast number of groups, some with an excessive number of members) as well as the connectivity

between some of them (e.g., the collaboration between the anime and pachinko industries in the manufacture of new games), fulfills the requirements of different audiences through different products and services. This results in a mass culture that seems to be completely in tune with capitalism, expanding globally and conquering a loyal group of fans designated in the country as *otaku*, and who have become an actual sociological phenomenon [8]. Currently, mass media supported by the decline of critical theory, contributed to a system that naturalized the "fan club" ideology in Japan, where the consumer public is addressed as a fan by companies in their marketing strategies [9]. As a result, the expression of being a fan, or otaku, of a particular *aidoru* (Japanese idol) or product has become a normative way of identifying oneself in contemporary Japan.

Aesthetic Variations. In this section, the main principles of Japanese aesthetics were briefly analyzed. Here, the term "aesthetics" appears as referring to a set of values and principles that allow for artistic distinctions to be made, where an aesthetic is characterized by distinction, clarity, and repetition [10].

Traditionally, nine Japanese aesthetic principles are identified, namely: *wabi-sabi; shibui; yūgen; iki; miyabi; geidō; ensō; jo-ha-kyu;* and *kawaii*. Some of these principles can also co-exist, e.g., given their origins, wabi-sabi, shibui and yūgen naturally share some qualities and values from Zen philosophy.

Wabi-sabi. Is composed of two distinct concepts, wabi (sober refinement, rustic beauty) and sabi (patina, antiquity) that have merged over the centuries. The inspiration of this aesthetic principle derived from ideas of simplicity, naturalness, and acceptance of reality, found in Taoism and Zen Buddhism that spread in Japan during the Heian period (794–1185) [11]. Thus, the values of wabi-sabi opposed the dominant aesthetics of the time, leading society towards a more rustic and detached ideology that emerged as a movement of counterculture to the cultivation of refined elegance, perfection, and polished beauty of Chinese aesthetics, and is typically associated with the *Heian* period. Wabi-sabi represented a departure from these ideals, giving value to objects that are imperfect, perishable. Thus, natural principles, such as the impermanence of objects, made them more pleasant, alluding to a depth and meaning that transcended their physical attributes. During the second half of the Muromachi period, the wabi-sabi movement gained influence, managing to penetrate almost all aspects of Japanese culture and sophisticated taste, largely modifying the view on the tea ceremony which had become an elitist activity at the time [10].

Shibui. Easily found in traditional arts and culture, shibui is considered one of the most relevant elements for understanding Japanese design [11]. The term first appeared during the Muromachi period, used to describe something with an astringent, bitter taste. During the first half of the Edo period, shibui came to express a discreet beauty, well crafted, but not too captivating, as opposed to ostentation and extravagance [12]. Similarly, De Mente defended shibui beauty as a carrier of serenity and sober luxury, distinguishing another type of shibui beauty that results from the elimination of everything that is unnecessary, reducing the objects to their essence, where the surface, color, and texture are serene, calming, elegant [11]. Thus, restraint is one of the main attributes of shibui, where shibui objects are muted and modest,

with euphemism, and an underlying notion that the least outstanding object will be the most artistically effective, as characteristics of this aesthetic [13].

Yūgen. Due to its origin as a concept of Zen Buddhism precise definitions are usually avoided, its meaning varying with its contexts from "mysterious beauty" to "profound grace" [12]. Thus, De Mente described yūgen as a reduction to the essence, interpreting the term both as "mystery" and "subtlety", used to refer to the beauty hidden beneath the surface or the mysterious grace or spirit of something that is only hinted at, but which is absent in visual terms [11]. To achieve this visually, De Mente suggested a design so simple that it is both subtle and elegant, including an asymmetrical touch of color or a single image as the focal point of an object left, for the most part, untouched.

Iki. Often interpreted as "originality", "uniqueness" or "refined style" [12], iki has its roots among the Japanese merchant class that gained economic influence during the Edo period, its origin often being attributed to the city of Edo itself. According to Graham, iki was more evident in the *yūkaku* (legal red-light districts) of large cities and in the erotic interactions between its participants, such as between *geisha* and their clients. The semantic context of this term was first explained by Kuki Shuzo (1888–1941) who defined iki as composed of three moments: *bitai* (coquetry), *ikiji* (pride and honor), and *akirame* (resignation), where the first constituted the basic tonality of iki while the last two defined the ethnic and historical coloring of a society [14].

In contemporary culture, iki can be observed in the interactions between the aidoru and their fans, defined by an affective, but limited, bond. The impossibility that a relationship with an aidoru can provide satisfaction is, in the end, the link between the otaku phenomenon and the commercialization of iki, where the aidoru will oscillate between an inaccessible ideal (the pure) and the infinitely available material (the sexual) [9].

Miyabi. Presented by Graham as the opposite of the understated and subdued beauty of shibui, wabi-sabi and iki, miyabi is related to a more opulent, refined elegance, often associated with the Japanese elite, where the spirit of *fūryū* or "elegant behavior" will be manifested [12]. Although particularly connected to the aesthetic preferences of aristocrats of the Heian period, the term evolved through sociological events, such as the rise of the *samurai* class to power and the appearance of great masters of the tea ceremony [15]. As expressed by De Mente, the rigor placed in the arts, and the values of the samurai, influenced Japanese artists and artisans who were encouraged to eliminate everything that was vulgar and extravagant from their works, seeking to incorporate elegance in everything they build. Likewise, the famous tea ceremony provided an important contribution to the concept of miyabi, preaching that for something to be truly beautiful it must be reduced to its essence, to the point where its spirit can be seen. Consequently, miyabi is related to a refinement that can make way for the grace and the politeness of appearance and good manners.

Geidō. It is the embodiment of discipline and ethics in traditional arts and crafts. One of the components shared between the written characters for *kyudō* (bow and arrow), *judō* (martial arts), *shodō* (calligraphy), *kadō* (flower arrangements) and *sadō* (tea ceremony) is the particle "*dō*" (道), marking the philosophical-religious

orientation of the practices [16]. Hence, geidō is not a visual aesthetic principle, but a way of transforming work or action into a medium of art. An example of this is in the geisha and how commitment, discipline and ethics are not only part of their work, but also of the way they lead their lives. Moving according to dō means moving with a natural spontaneity as an embodiment of the concept of "non-action" where the movements of a geisha while serving tea, or of a *nō* actor during a performance, go beyond activity and passivity, where the world moves the body as much as the body moves in the world [16]. Geidō will allow for a piece to be more than an object of aesthetic judgment, enabling an appreciation for the creation process.

Ensō. One of the most widespread images of Zen art, ensō is described as both the simplest and the most complex form, relating a hand-drawn circle formed by a single brush stroke. Strongly linked to Zen philosophy, the image of ensō must include four other minor aesthetic principles, namely: *fukinsei* (asymmetry, irregularity); *kanso* (simplicity); *shizen* (without pretense, natural); and *datsuzoku* (freedom from habit) [17]. Regarding the latter, more valuable than the expression and execution of form, ensō is created to convey the expression of an artist's mind when unfettered. That is, the appearance of the circle will depend not only on their style but also on the way they conduct their life at the time of creation. Thus, ensō is not only an artistic representation but a transformative experience.

Jo-ha-kyu. It is a concept of modulation and movement where three tempos are used, translating a rhythm where rituals and performances will start slowly, build momentum and end quickly. Zeami Motokiyo (1363–1443), master of nō theater, was the first to write about this aesthetic principle, describing it as a rhythm innate to the world and, as such, everything naturally obeys the law of the jo-ha-kyu process, where any work or action that has jo-ha-kyu as a fundamental aesthetic principle will have the same principle present either in its general structure (macro) or in other smaller jo-ha-kyu cycles (micro) that constitute it [18]. Consequently, although it is most frequently discussed in traditional Japanese arts (nō theater, tea ceremony, martial arts, etc.), the jo-ha-kyu rhythm can also be found in modern culture; music, cinema, contemporary dance, and even advertising.

Kawaii. It signaled the concept and culture of the "adorable" in modern Japan, incorporating three basic characteristics: *itawashii* (pitiable); *aisubeki* (lovable); and *chiisakute utsukushii* (small and cute) [19]. Hence, kawaii refers to any object or person that retains traditionally childish attributes and behaviors, capable of triggering a protective and affective response in people. In everyday objects, it will render a powerless/helpless appearance to objects, making them empathetic, while in people, especially young women and teenagers, neotenic attributes and a delicate, gentle behavior with a higher tone of voice are appreciated and even encouraged [11]. Over the years, other ramifications of kawaii have also emerged in Japanese society (*kimokawaii*, *yamikawaii*, *yumekawaii*, etc.) to illustrate the thoughts and sensibilities of different groups of people—the psychology behind kawaii leading to its success with the mass audience, enticing different individuals across all age groups. Consequently, kawaii has become the most visible aesthetic principle in Japan's consumer and entertainment products category, constituting a safe bet for brands and companies that want to succeed in the Japanese market [11].

4 Methodology

After collecting the necessary information to ground this study, a research plan was established in two phases: an observational phase, where all the study material was gathered; and a confirmational phase, based on visual research [20]. In its entirety, the investigation was organized according to an empirical methodological proposal of a case study, carried out in the cities of Kyoto, Osaka, and Tokyo [21]. The results shown in this paper relate to the sample gathered in Kyoto city, which we analyzed in order to validate the following research hypothesis: Outdoor advertising in Kyoto frequently presents elements of traditional culture.

4.1 Characterization of Research

Sample Characterization. By means of an external quantitative research method (field study), a vast study material related to the city of Kyoto was collected during the period from October 2018 to March 2019. To construct the sample, photographic material of outdoor advertising objects was collected randomly in the areas of *Fushimi*, *Higashiyama*, *Kamigyo*, *Nakagyō*, *Sakyō,* and *Shimogyō*.

From a wider first collection of research material, the final sample was taken, thus being classified as a non-probabilistic sample for convenience, composed of 180 study objects from 67 different – national and international – brands.

Procedures. Once established our sample, the analysis of each advertising object took place through the creation of a coding sheet capable of showing advertising trends and proving the research hypothesis. Thirteen study variables were identified in this coding sheet: Brand; City; Product/service category; Communication channel; Material; Size; Placement; Type of technique; Light; Approach; Dominant palette; Visual Elements; and Content Description. These variables (attributes of the advertising objects) were then divided into 70 sublevels (variations of these attributes), classified according to the most representative component of each variable.

A second evaluator, with knowledge of graphic design and the Japanese language, analyzed the Kyoto sample using the coding sheet created, allowing for the discussion of some variables and the detection of discrepancies. In the end, two coding sheets were built to analyze the Kyoto sample considering nine variables: Communication channel; Material; Size; Type of technique; Light; Type of approach; Dominant Palette, and Visual Elements, (the other variables were omitted for requiring an advanced knowledge of the study universe by the second evaluator). After that, Cohen's kappa was calculated to infer whether the agreement between evaluators was superior to the agreement by chance. The final validation of this coefficient showed excellent results in the level of agreement with $k > 0.800$ and $p < 0.001$ in all weighted variables.

Table 1 Frequencies for the visual elements variable in the Kyoto sample

Visual elements	Kyoto sample
Japanese characters	38.3% (69)
Latin characters	18.9% (34)
Japanese and Latin characters	10.6% (19)
Product	8.3% (15)
Celebrity	2.2% (4)
Celebrity and product	-
Manga/Anime	0.6% (1)
Mascot	2.2% (4)
Traditional elements	16.7% (30)
Contemporary elements	–
Traditional and Contemporary elements	1.1% (2)
Model	1.1% (2)
Total	100% (180)

Upon refining our coding sheet, we proceeded with the final analysis of the sample, the results being accounted for and presented using the most appropriate tables for this purpose and with all quantitative data obtained using the SPSS tool.

In the final phase of this study, a discussion and interpretation of the results within cultural and aesthetic contexts was carried out, allowing us to recognize intentional attributes that constitute different aesthetic principles and explain the possible meaning of some trends with relevant examples.

Results. The data of the variables that express significant results to the investigation was examined below. To support the prediction of the hypothesis raised, the frequencies for the variable "Visual Elements" was observed (Table 1).

The results show that the sample values mainly four sublevels in the "Visual elements" variable, with the following order of perceived importance: (a) Japanese characters; (b) Latin characters; (c) Traditional elements; and (d) Japanese and Latin characters. Considering the customary use of written characters in advertising for its informative and descriptive purpose, it is apparent that elements of traditional culture are the most distinguishing elements in Kyoto's outdoor advertising, according to the sample.

The study of other variables provided additional results that contributed to an understanding of further preferences, demonstrating interesting trends in variables such as "Type of technique", "Dominant palette", "Approach" and "Material".

For the variable "Type of technique", the most valued sublevels for the sample follow the perceived order of importance: (a) Typography; (b) Calligraphy; (c) Illustration; and (d) Realistic photography. These results can be correlated to the results for the variable "Visual Elements", however, it is to note that the value for the sublevel "Calligraphy" (25.6%) displays an interesting trend, especially when compared to the results found in the Osaka and Tokyo samples. Despite written characters (Japanese

Table 2 Frequencies for the type of technique variable in the Kyoto sample

Type of technique	Kyoto sample
Realistic photography	10.0% (18)
Illustration	14.4% (26)
Montage	7.2% (13)
Calligraphy	25.6% (46)
Typography	37.2% (67)
Calligraphy and typography	3.9% (7)
Sculpture	1.7% (3)
Total	100% (180)

characters; Latin characters; and Japanese and Latin characters) being the most representative elements of outdoor advertising in all samples, the sublevel "Calligraphy" is undervalued in the Osaka and Tokyo samples, making up 6.7% and 3.3% of the total sample value for the variable, respectively [21]. Consequently, the analysis of the variable "Type of technique" in the Kyoto sample reveals an affinity for the use of Calligraphy that is not as perceived in the other two samples (Table 2).

Another finding involves the "Dominant palette" variable. Containing four sublevels, the variable shows the same value for its most frequent sublevels: Sober colors (31.1%) and Black and white (31.1%), followed by the Vivid colors sublevel (23.9%) as the third most observed in the sample.

It can, therefore, be established that the sample favors a palette that tends to blend in rather than stand out. The results found for the Kyoto sample, not only demonstrate the effects of the restrictions imposed by the government on outdoor advertising in terms of color palette but also indicate that there is still a considerable number of cases that evade such ordinances, presenting a noteworthy value for the use of Vivid colors (Table 3).

Supporting only two sublevels, the variable "Approach" (Table 4) presents very

Table 3 Frequencies for the dominant palette variable in the Kyoto sample

Dominant palette	Kyoto sample
Vivid colors	23.9% (43)
Sober colors	31.1% (56)
Pastel colors	13.9% (25)
Black and white	31.1% (56)
Total	100% (180)

Table 4 Frequencies for the approach variable in the Kyoto sample

Approach	Kyoto sample
Emotional	7.2% (13)
Rational	92.8% (167)
Total	100% (180)

Table 5 Frequencies for the material variable in the Kyoto sample

Material	Kyoto sample
Paper	23.9% (43)
Acrylic	35.0% (63)
Fabric	9.4% (17)
Wood	10.6% (19)
Vinyl	9.4% (17)
Canvas	6.7% (12)
LED lights	1.1% (2)
Other	3.9% (7)
Total	100% (180)

Table 6 Frequencies for the communication channel variable in the Kyoto sample

Communication channel	Kyoto sample
Poster	16.7% (30)
MUPI	5.0% (9)
Electronic screen	1.1% (2)
Billboard	6.7% (12)
Gable	0.6% (1)
Window/storefront	5.0% (9)
Lantern	4.4% (8)
Curtain/cloth	8.3% (15)
Signboard	17.8% (32)
Self-luminous signboard	15.0% (27)
Lateral signboard	11.7% (21)
Totem	2.8% (5)
Easel	3.3% (6)
Banners	–
Other	1.7% (3)
Total	100% (180)

high values for the Rational sublevel in the sample (92.8%). This discrepancy seems to be directly related to the results obtained for the variable "Visual elements", in which sublevels with a more cognitive disposition (Japanese characters, Latin characters, Japanese and Latin characters) represent 67.8% of the total sample value.

The analysis of the variable "Material" (Table 5) presents the following order of perceived frequencies in the sample: (a) Acrylic; (b) Paper; (c) Wood; and (d) Fabric and Vinyl with the same value, (9.4%). This variable seems to be directly connected to the variable "Communication channel", analyzed in Table 6.

According to Table 6, the most valued sublevels: (a) Signboard; (b) Poster; (c) Self-luminous signboard; and (d) Lateral signboard, demonstrate a tendency for the

use of more conventional communication channels in the Kyoto sample. The results gathered in this table also account for the impact of the restrictions imposed on outdoor advertising, affecting the frequencies of certain sublevels within the variable, e.g., limiting the use of billboards and electronic screens in the Kyoto sample, which is particularly noticeable upon observing the higher value of these sublevels in the Osaka and Tokyo samples [21].

Qualitative Assessments. After describing and quantifying the results found, i.e., completing the content analysis, the quantitative data obtained is related to the theoretical framework developed previously, with the aim of explaining the trends found and translating some of the visual and non-visual aspects of outdoor advertising in the sociocultural context of Kyoto.

Adapting outdoor advertising to a regional cultural preference. The analysis of quantitative results revealed that outdoor advertising in Kyoto has a great affinity for showcasing elements of traditional Japanese culture. A company that seemed to understand regional differences and use them to communicate effectively was the soft drink maker The Coca-Cola Company, where its campaign *Region-limited Bottles* supported unique regional designs while maintaining the brand's typical colors. The representation of regional characteristics benefited both the inhabitants, invigorating their feelings towards their regions, and the brand, especially considering that, in Kyoto, advertisements with a historical design favor a relaxation of the restrictions imposed [5]. Thus, the representation of traditional elements, such as *hanami* (the custom of viewing cherry blossoms) and the 150 years celebration of the Meiji Restoration (Fig. 1), can be considered a reason why Coca-Cola posters could be found at the entrance of local stores, despite their vivid red color.

Adapting outdoor advertising to a regional aesthetic preference. Aesthetic contemplation will break the common semantic meaning of an object, both on an initial material level and on the possible level of its representations [22]. Admitting

Fig. 1 Coca-Cola Posters affixed at the entrance of local businesses, Kyoto, 2019. Photographs by Ana Seixosa

a contemplative and open act, where the aesthetic pleasure is in the existence of the object, not in its purpose, it is possible to analyze advertising objects as objects capable of provoking aesthetic appreciation.

As discussed in the literature review, to continue advertising in the city, some brands had to adapt their advertising objects to the requirements stipulated by the Kyoto government [3, 5]. Although not labeled as such, the compliance with some of those requirements could be interpreted as following some previously studied Japanese aesthetic principles.

Figure 2 shows advertisements created for different brands in Kyoto. Due to their high saturation, considered disruptive to the city's landscape, the brands' usual vivid colors were replaced. The color palette often chosen as a substitute, composed of various shades of chestnut and russet, is considered a necessary attribute to produce the calm and subdued effect of shibui [11]. Ultimately, the adaptation of outdoor advertising in Kyoto considering the characteristics of the kyo-machiya will insinuate such attributes, naturally associated with shibui beauty.

On the other hand, in the lateral signboards of the city, where the government required fixed standards to be followed regarding dimensions, design, and placement [5], a dominance of the Black and white palette was observed in the "Dominant palette" variable. Especially in the commercial-residential, historical, and aesthetic preservation districts of Kyoto, the lateral signboards were mostly composed of white acrylic and black colored fonts, some bearing the name of the establishments in calligraphic strokes. Recounting the results obtained for the variables "Type of technique" and "Dominant palette" (see Tables 2 and 3) and observing Fig. 3, we can attest the affinity of the Kyoto sample for the usage of Black and White and Calligraphy. This type of design seems to make a deliberate allusion to the Japanese calligraphic art, shodō, whose name admits to conveying the geidō aesthetic.

It is concluded that there is an appreciation on the part of outdoor advertising in Kyoto for the representation of Japanese calligraphic styles, equally sustained by its

Fig. 2 Different brands adapt their colors according to a similar color palette, Kyoto, 2019. Photographs by Ana Seixosa

Fig. 3 Lateral signboards of different businesses displaying calligraphic strokes, Kyoto, 2019. Photographs by Ana Seixosa

inhabitants who remain more faithful to the arts and to the traditional methods in relation to the rest of Japanese society [6].

Regarding the variable "Material", this investigation pointed to a significant frequency for the use of natural materials in the Kyoto sample in comparison to the Osaka and Tokyo samples [21]. The results obtained for the variable "Communication channel" showed that the Poster sublevel reached great significance in the Kyoto sample. Furthermore, the poster was the only communication channel observed that, separated from its business, managed to enter and advertise in the aesthetic and historic districts of the city, such as in the *Gion Shimbashi* district where they were affixed in front of several kyo-machiya (Fig. 4). In this scenario the presence of the advertising poster enhanced the local landscape by transmitting the atmosphere and lifestyle valued both by the city and its inhabitants, as well as by tourists who seek these places for their historical value. The use of the posters at historic sites, where rows of kyo-machiya were built, does not take from its beauty, rather it helps the city to return to a human scale, reminiscent of the ancient times cherished in Kyoto.

Fig. 4 Posters affixed in front of kyo-machiya, Kyoto, 2019. Photographs by Ana Seixosa

Equally more evident in these areas was the use of traditional paper lanterns, which convey the wabi-sabi and shibui aesthetics [11], and wooden signboards. Although wooden signboards are less decorative, and regularly used for identification functions, this purpose could become secondary to the natural character and patina that this medium can hold. Figure 5 illustrates one of these cases, where *Okamoto Orimono Honten* kept its wooden sign, despite having lost its legibility over the years.

Time stripped this advertising object of its initial purpose, welcoming the wear and tear and the imperfections characteristic of the wabi-sabi aesthetic, which add a higher value—a different function—to the store than originally intended. The communication channels added around it (such as the lateral signboard and the totem at the entrance) extend the traditional character of the store by choosing to work with wood instead of other more popular materials of modern times, e.g., acrylic, which is most often used in lateral signboards across all samples [21].

Fig. 5 Okamoto Orimono Honten, Kyoto, 2019. Photograph by Ana Seixosa

5 Discussion

Regarding the initial question of this study about the ability of outdoor advertising of adapting to the environment in which it operates, more specifically, if in the advertising universe of Kyoto outdoor advertising presents distinct cultural preferences, the results found suggest that:

1. Cultural preferences are empirically validated in advertising objects made for the city of Kyoto through the analysis of the variable "Visual elements".
2. Visual and sensory attributes of wabi-sabi, shibui, and geidō aesthetic principles are manifested in Kyoto advertising through the variables "Type of technique", "Dominant Palette" and "Material".
3. Brands tend to communicate discreetly and sparsely, focusing on descriptive and informative advertisements as pointed out by the study of the "Approach" variable. Furthermore, the restrictions on outdoor advertisements appear to limit the representation of visual elements, especially non-traditional ones, and denote characteristics easily associated with traditional aesthetic principles preserved by folk and alternative culture.

In this perspective, it is argued that a solution for brands whose advertising objects are prevented from communicating in Kyoto may involve the adaptation of their advertisements according to the variables analyzed above.

Lastly, we recognize that an initial imbalance in some variables studied in the Kyoto sample (especially when compared to the other two samples), as well as in some of the results, was a limitation of this study, predicted from the beginning due to the restrictions imposed on outdoor advertising.

6 Conclusions

This study demonstrated ways in which the representation of regionally valued cultural elements and aesthetic principles in advertising could improve the communication of a city's identity and lead to a greater acceptance of advertising objects in public spaces. Consequently, this study offered good practice guidelines for brands wishing to communicate more effectively in Kyoto and establish a prosperous relationship with its inhabitants.

Although the adaptation of outdoor advertising to the city of Kyoto is not entirely voluntary, the fact remains that the incorporation of traditional aesthetic attributes, both physical and intangible, has allowed brands to reflect a "sense of Kyoto" in their advertising objects, instead of a universal look at what is considered beautiful and pleasant. From this angle, it is proven that when advertising incorporates the values and aesthetics more suited to a place, the place, as well as its inhabitants, are more likely to accept the advertising objects, perceiving them as inspiring and intensifying their intrinsic principles.

However, it is important to note that these benefits will not come from a simple absorption of the culture and aesthetic pattern historically associated with the region, seeing that repetition cannot add new value. It is not enough to represent the identity of different regions; brands must strive to deliver innovation while honoring the cultural context of a given region. Despite the success of some brands in representing Kyoto's identity, the adaptations made can be read as retrograde: the aesthetic concepts found in the city's outdoor advertising, although often referred to when discussing Japanese art and graphic design, are vocabularies hardly used by contemporary Japanese society in everyday conversations.

Moreover, even though they represent the city and the characteristics generally addressed to the people of Kyoto, it is important to remember that different cultural elements (elements of folk culture, alternative culture, and mass culture) are present in each individual, albeit in different proportions. In this sense, especially in urban and naturally more modernized areas, it is important to also represent the renewal of Japanese society, which does not have one constant taste, idealized by local identity. The complexity of contemporary Kyoto society must be considered when formulating restrictions imposed on external agents, in order not to compromise the urban experience and restrict its inhabitants to an immutable image of themselves.

It is concluded, therefore, that restrictions imposed on outdoor advertising can be beneficial for cities, however, there is still great potential in the creative freedom of brands. We find ourselves in an era in which technological progress and globalization standardize places, building tension between local and cosmopolitan styles and values, yet these same advances can offer solutions to the problems they cause.

That said, the adaptations of external agents to the place should not be used superficially with the aim of attracting or triggering a transaction on the part of a potential consumer, but with the desire to actively contribute to the urban experience of the human being, increasing the value built within the physical spaces that make up their city, their home.

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Brand Management: From Storytelling to Strategic Narratives

Sérgio Dominique-Ferreira, Sofia Praça, and Catherine Prentice

Abstract Strategic brand management presupposes the use of different strategies. The dimensions. In this theoretical chapter, the authors analyze how the most known concepts are related. As a result, brand equity plays a great importance in brand image and brand identity, implying different approaches in the communication process of brands. Consequently, storytelling plays a specific role in brand communications, especially digital storytelling. Creating appropriate narratives, brands can improve customer engagement, consumer's emotional involvement and loyalty.

1 Introduction

1.1 Branding

Brands play important functions for both companies and consumers. According to the American Marketing Association (AMA 2022) the brand is defined as "a name, term, design, symbol or any other feature that identifies one seller's a goods or service as distinct from those or other sellers", without forgetting that the main purpose is the differentiation. As a result, branding is a major concept in the marketing literature because it is one of the most valuable intangible assets of companies [75].

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According to Olins [113], branding is a complex, versatile and multidisciplinary management activity that allows companies to improve brand reputation and brand awareness. It can also strengthen consumer involvement with products, which, in turn, improves to attract and retain customers [86, 122].

Aaker [5] discusses the internal brand and the external brand as important functions in developing a brand. Internal brand emphasizes increasing creativity among employees, showing positive impacts on both stakeholders. It also allows to share brand values. The external brand, on the other hand, is focused on the consumer.

Currently, the branding process includes primary elements of the brand such as visual identity, nomenclature, slogan, or positioning. In this context, developing a Storytelling (ST) provides consumers with a new and more positive experience. When strategically developed, ST improves the relationship between customers and brands, increasing customer loyalty [9, 56].

1.2 Brand Equity

Brand Equity (BE) became popular in the 1980s. Several authors such as Aaker [5], Feldwick [47] and Keller [73] defined BE based on different perspectives, as well as its impact on companies' financial performance [38]. Another perspective focuses on BE through the consumer's lens, highlighting the possible positive perceptions created by BE [6, 73, 116, 154]. Aaker [2, p.68] defined BE as:

> A set of assets and liabilities linked to a brand, name, and symbol, which are added to or subtracted from the value provided by a product or service to a company. For certain assets and liabilities to determine brand equity, they must be linked to the name and/or symbol of the brand. If the brand name or symbol is changed, some or all the assets could be affected, and even lost.

Aaker [6] developed a BE model based on five dimensions: (i) brand awareness, (ii) perceived quality; (iii) positive associations caused by the brand; (iv) consumer loyalty to the brand; (v) other assets of the brand. The first four components are directly related to the consumer and the last dimension concerns the financial value of assets that create exclusivity and competitive advantage, such as patents and trademarks. Figure 1 illustrates each of these five dimensions, providing a detailed explanation.

However, Keller [73] developed the Customer-Based Brand Equity (CBBE) model, providing a framework that incorporates the role of consumers' knowledge and feedback. Keller defines it as "the differentiating effect of brand knowledge on consumer response to brand marketing" [73, p. 14]. In the CBBE model presented by Keller, four steps are presented to develop a brand (branding goals) as follows:

1. Define a brand identity, that is, establish a certain breadth and depth of brand awareness.
2. Create appropriate meaning for the brand through strong, favorable, and unique associations.
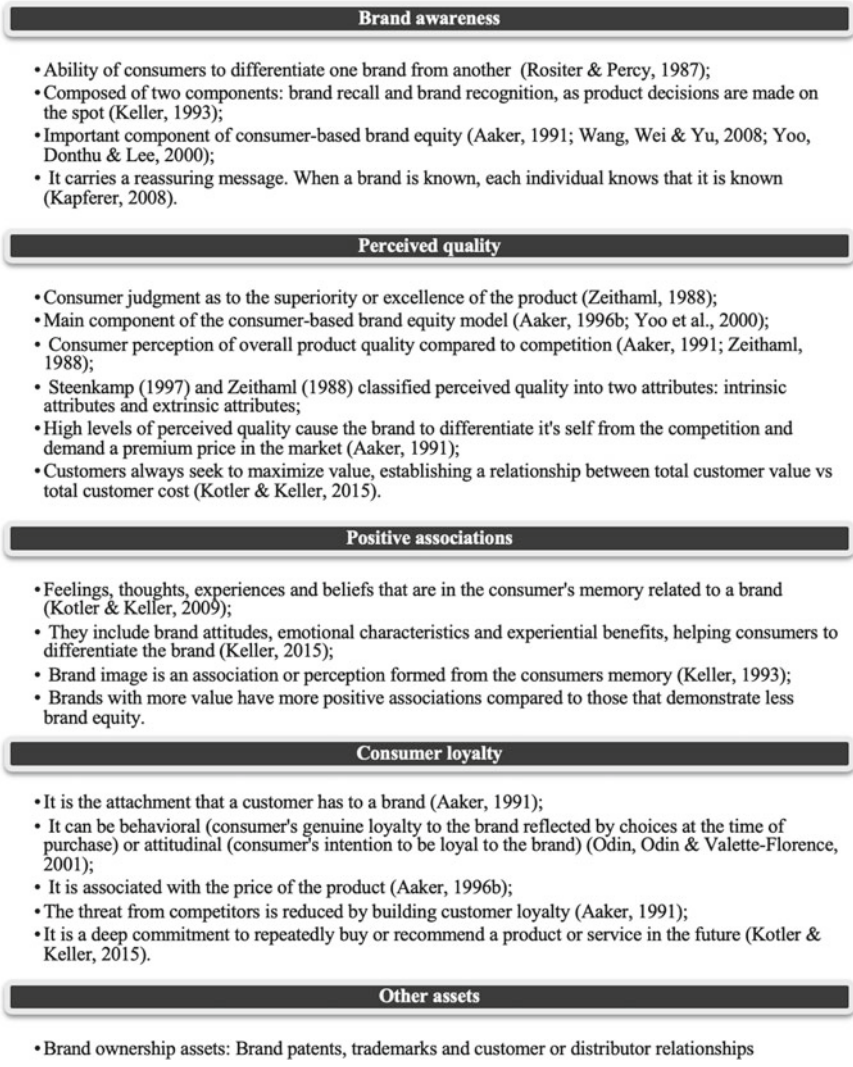
Brand awareness

- Ability of consumers to differentiate one brand from another (Rositer & Percy, 1987);
- Composed of two components: brand recall and brand recognition, as product decisions are made on the spot (Keller, 1993);
- Important component of consumer-based brand equity (Aaker, 1991; Wang, Wei & Yu, 2008; Yoo, Donthu & Lee, 2000);
- It carries a reassuring message. When a brand is known, each individual knows that it is known (Kapferer, 2008).

Perceived quality

- Consumer judgment as to the superiority or excellence of the product (Zeithaml, 1988);
- Main component of the consumer-based brand equity model (Aaker, 1996b; Yoo et al., 2000);
- Consumer perception of overall product quality compared to competition (Aaker, 1991; Zeithaml, 1988);
- Steenkamp (1997) and Zeithaml (1988) classified perceived quality into two attributes: intrinsic attributes and extrinsic attributes;
- High levels of perceived quality cause the brand to differentiate it's self from the competition and demand a premium price in the market (Aaker, 1991);
- Customers always seek to maximize value, establishing a relationship between total customer value vs total customer cost (Kotler & Keller, 2015).

Positive associations

- Feelings, thoughts, experiences and beliefs that are in the consumer's memory related to a brand (Kotler & Keller, 2009);
- They include brand attitudes, emotional characteristics and experiential benefits, helping consumers to differentiate the brand (Keller, 2015);
- Brand image is an association or perception formed from the consumers memory (Keller, 1993);
- Brands with more value have more positive associations compared to those that demonstrate less brand equity.

Consumer loyalty

- It is the attachment that a customer has to a brand (Aaker, 1991);
- It can be behavioral (consumer's genuine loyalty to the brand reflected by choices at the time of purchase) or attitudinal (consumer's intention to be loyal to the brand) (Odin, Odin & Valette-Florence, 2001);
- It is associated with the price of the product (Aaker, 1996b);
- The threat from competitors is reduced by building customer loyalty (Aaker, 1991);
- It is a deep commitment to repeatedly buy or recommend a product or service in the future (Kotler & Keller, 2015).

Other assets

- Brand ownership assets: Brand patents, trademarks and customer or distributor relationships

Fig. 1 Brand equity model adapted from [6]

3. Challenge brand responses that are positive and favorable.
4. Generate relationships with consumers, investing in intense and constant loyalty.

To accomplish those four stages, it is necessary to develop the six building blocks of a brand: salience, performance, imagery, judgments, feelings and, finally, the resonance that the brand causes in the consumer [76]. Brand awareness is not just related with specific facts of the brand, but also about the thoughts, feelings, perceptions,
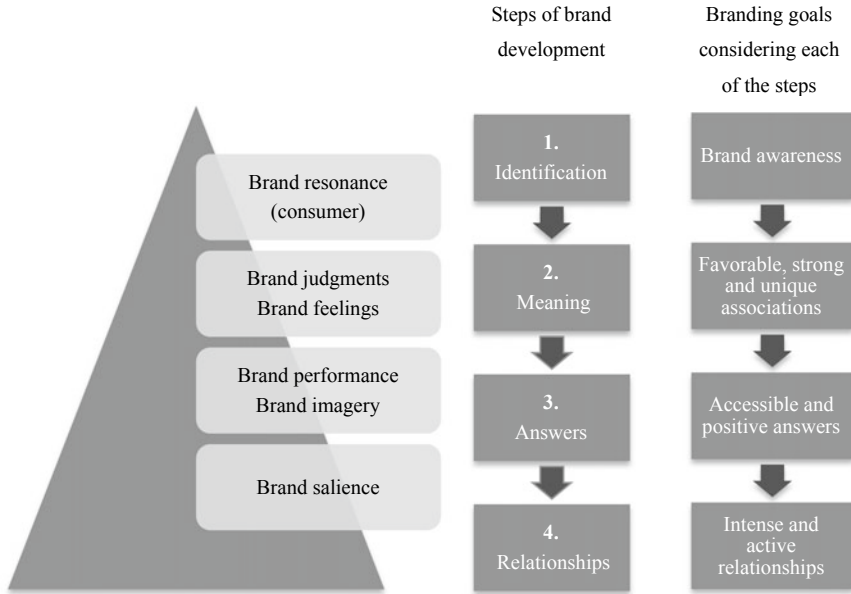
Fig. 2 Model CBBE adapted from Kapferer (2009)

images, experiences and everything that connects the brand to consumers mind [74]. Figure 2 summarizes, all of Keller's thinking.

Also related with BE, Keller and Machado [77] refer that a key element in brand development is the choice of brand signs. This BE strategy influences the perception of consumers, such as price sensitivity.

According to Kotler and Keller, BE is the added value on products of a certain brand, reflected in the way consumers think, feel and act in relation to the brand. Furthermore, the greater this value, the greater its impact on the way consumers think, feel and act in relation to the brand. Still, the perception of this value will also have a direct impact on prices, market share and even the profit of companies. In this sense, BE is an important intangible asset that adds psychological and financial value to brands.

Brands with strong BE have important benefits, such as consumer loyalty and greater market share [78]. Therefore, BE is a concept of great relevance within the universe of brands, however, there is still a certain lack of consensus around the concept (Wood 2000). Further developments are crucial as brands with a high levels of BE are stronger [52], as well as the relationship between BE and customer engagement [114].

1.3   From Brand Image to Brand Identity

According to Kotler (1993, p. 269), brand image (BI) is "the set of beliefs about a particular brand" and it is developed during the process of decoding the six dimensions of the brand identity [65, 130]. It is also reflected by brand associations kept in the consumers' memory, thus influencing purchase decision making [73]. These associations can be classified into three types, such as, attributes, benefits, and attitudes.

Elements such as brand personality play a relevant role in the development of brand image since consumers prefer a certain similarity between their own personality and the attributes of the brand's personality. In other words, consumers prefer brands that match their self-image [20, 93]. However, according to Brito [24], the image will not only depend on its identity signs, but also on the brand positioning, combining preferences, strength and exclusivity of the associations developed.

In consequence, transmitting a brand image to a target market is key [117]. Because changes in brand image are not instantaneous, they occur over time. Instead, the value of a brand progressively adjusts to match its real value of exclusivity or similarity [84].

According to Malik et al. [93] there are two perspectives: the perceived image, which corresponds to the way consumers interpret a certain brand, positioning themselves on the receiver's side and the desired image, which represents how the organization intends to position the brand, so that it corresponds to the image perceived by consumers referring to the brand identity. The brand image is passive and focused on the past, in contrast to the brand identity, which is more active, projecting the future [1, 71]. So, the search for a balance between identity and image is complex [129].
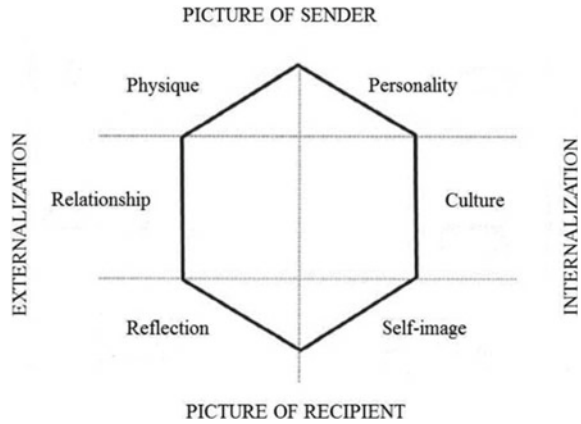
Meanwhile, some authors merge both concepts—identity and brand image— suggesting that the process by which an image is developed in the minds of consumers comes from the way in which the identity is developed and shared.

Kapferer [71, p. 171] defines brand identity as "the set of beliefs of the brand and its core values". Identity must be unique, timeless, consistent, coherent, and adaptable, composed by the brand's own identity, with a purpose and meaning [3].

But a successful brand identity also needs to fulfill three functions: be in agreement with consumers, differentiate the brand from competitors, and match what the company can and will do over time [47]. Accordingly, companies should establish the personality of the product and the value proposition, promote this personality, including emotional involvement.

In this context, Kapferer [70] presents a model based on a sender-receiver relationship between brands and consumers. The first assumption is that brands send and develop the brand identity, developing the "Brand Identity Prism". This model is composed by six dimensions, divided in two dimensions: horizontal and vertical. The horizontal axis presents the elements corresponding to the sender and receiver, as well as the intersection between them. Subsequently, in the vertical axis, the social

PICTURE OF SENDER

Physique   Personality

EXTERNALIZATION   Relationship   Culture   INTERNALIZATION

Reflection   Self-image

PICTURE OF RECIPIENT

or observable elements are visualized, divided by externalization (physical, relationship and reflection) and internationalization (personality, culture, and self-image). Figure 3 illustrates the "Brand Identity Prism".

The strategic management of those elements will determine the success of brands. The congruence between the brand identity and the brand image is critical to develop positive associations [43].

1.4 Marketing Communication

Integrated marketing communications has evolved over the last years. Keller's CBBE model [73] is a good example of how a mix communication platform can increase brand awareness. The traditional advertising approach is being replaced by digital options.

Traditionally, communication was unidirectional, opposing to the current multi-directional and interactive nature of communication [63]. Additionally, current consumers are more informed and demanding. Therefore, companies need to use new forms of communication, sending messages that are increasingly customized [11, 13, 152]. Accordingly, the (marketing) communication mix includes eight main components: mass media, such as advertising, events, experiences and public relations, direct marketing, interactive marketing [15]. Word-of-mouth (WOW) and sales promotion are more personal types of communication.

Regarding marketing communication strategies, the narrative developed by brands stands out, combining literary narrative techniques and a narrative discourse. This strategy enables brands to communicate with stakeholders, highlighting the authenticity of brands [103]. Thus, storytelling plays an important role in brand communication aimed at consumers.

1.5 Storytelling

The process of telling stories is something that is inherent to the human being and it is considered one of the oldest arts. With the evolution of the world and the introduction of new technologies within society, turning human beings into authentic storytellers [59, 144].Within the academic community, it has not been easy to find a universally accepted definition. There is a considerable confusion between "story" and "narrative". Some authors consider that the concept "narrative" should be considered a synonymous of "history".

According to Hyland [62, p. 1], a narrative "is a spoken or written account of connected events: a story". Differently, Elçi & Çubukçuo (2014, p. 38) refer that "a synonym of the term narrative is history", considering that they allow structuring experiences and knowledge. Other authors consider that the concepts are totally different, although related to each other [30, 141]. As a result, ST is perceived as an art from "a film, or an advertising campaign to commercial information or the presentation of a company", sending a specific message, while involving and promoting audience participation [110, p. 20].

ST uses narratives for the organization's communication involving customers [131]. ST presupposes a bidirectional interaction, written or oral, between someone who tells a story, and it is a well-known and powerful means of communicating messages and engaging the public [140, p. 1]. Stories are important as they appeal to different dimensions of consumers, emotions, intellect, body and will [142, p. 28].

In line with this reasoning, Xavier [150] presents three dimensions related to ST: pragmatic, pictorial and poetic. Pragmatics is the technique of elaborating and linking scenes, the pictorial art is the art of molding and putting together the pieces of a hypothetical puzzle; the poetics is the technique of building imaginary memories full of meanings. From another perspective [138] states that ST applied to brands is not like the narrative of cinema, i.e., a simple and functional structure is required, with a beginning, middle and an end that can be invoked from context, action and result, respectively.

When brands communicate clearly, immediate recognition is achieved (developing brand awareness), increasing emotional bonds with consumers [105]. In this context, authenticity plays a crucial role. From a brand strategy perspective, authenticity is a key element for successful brands, as it forms part of a unique brand identity [2]. However, the concept of brand authenticity is complex and multifaceted, since it is an assessment of the consumers' perception of what they consider to be true or genuine, rather than being an objective and already consummated fact [50, 58]. If brands don't reflect what they really are, they will be perceived as inauthentic brands [17]. As so, authenticity has been part of ST of brands as a way of brands producing appealing content. To this end, they develop narratives, with a properly structured and interconnected thread, with convincing characters. Simultaneously, they design their products in an engaging, attractive and effective way [146].

In order to appear authentic, the development of the brand story will have to be partially honest, that is, it does not need to be true word for word, the important

thing is that it seems credible and authentic in a merely sufficient measure [16]. Consequently, it will be the consumers to decide whether the story is perceived as authentic [61]. This perceived authenticity is key in ST [68, 91].Additionally, consumers can be disappointed when they believe the story is totally true and later discover that it was made up and manipulated, a negative connotation that no brand wants to have, as it is easy to oversimplify the truth and distort everything else [127].

Storytelling as a branding strategy

ST plays an important role in branding as the brand reflects all corporate and communication behaviors based essentially on the feedback of customers [54]. In fact, literature has long recognized the power of stories to provide brand meaning, and so professionals have decided to use ST to enhance consumer involvement [25, 57, 149].

ST can be a tool to create brand value, to create a clear and differentiated brand positioning, as well as an emotional bond between consumers and brands/products [98]. Additionally, when marketers only adopt and confront consumers with more quantitative facts and arguments, they end up creating more distance with consumers (e.g.: skepticism, loss of confidence) [14]. That is why it is common for stories to fascinate consumers, becoming thoughts and memories that are easy to retain, strengthening and increasing positive associations to brands, as well as increasing customer loyalty [54, 91]. So, the main intention is to create a bond and a genuine connection between brands and consumers. This can be achieved using universal archetypes[1] that, applied to the ST, are associated with heroic story patterns played by the characters within a narrative context, demonstrating all their characteristics, motivations, values, virtues and fears [27, 45, 133, 145].

The modern consumer is no longer guided by the same values as previously [92]. Well-positioned brands occupy specific niches in the minds of consumers and, therefore, in certain ways, are easily identifiable, similar and different compared to competing brands [79]. Pulligadda et al. [123] said that consumers who develop affective connections with the brand through stories show a greater tendency to share their experiences with others. As a result, they report that the loyal public is also more willing to spend a greater amount, if it is to develop their favorite brands.

Digital Storytelling

Digital storytelling or Digital Storytelling (DS) was originally developed as a tool for community interaction, development and empowerment in the 1990s by Joe Lambert and Dana Atchley [33]. The attractiveness of this form of digital expression is underlined by the fact that these stories can be created by people anywhere, on any subject, and shared electronically across the world.

According to Jensen [67, p. 53] stories are "[…] statements of value, and the product is just an appendix to incorporate any story that is being sold". This approach reflects the value that is given to stories and that in the digital context can also be applied. In this sense, Miller [102] defines DS as narrative entertainment that

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[1] Forms or images of a collective nature that represent a typical human experience, such as tales, myths, acts of heroism, among others.

reaches its audience through technology and social media, highlighting interactivity as something important in brands. This definition focuses the crucial and differentiating aspect of the DS that uses digital technology as a support and the possibility of sharing between the user and the content creator [8].

Joe Lambert, co-founder of the Center for Digital Storytelling, a non-profit arts organization in Berkeley, California, is known for developing and promoting the seven elements of digital storytelling that are an advantageous starting point for getting started with digital stories. The seven elements of digital storytelling, according to the founder are presented in Fig. 4.

Later, Lambert [88] updated the seven elements, maintaining and/or improving those that were already part of it, adding others that are equally important, such as: general objective of the story, the choice of content; voice clarity; narrative rhythm; quality of images, video and other multimedia elements; and still, good grammar and use of language.

Digital art consists of creating a short film, combining digital artefacts such as images, text, video clips, animation, and music, with a computer program as a technological base. Usually, they have a narration in the form of recorded audio, which
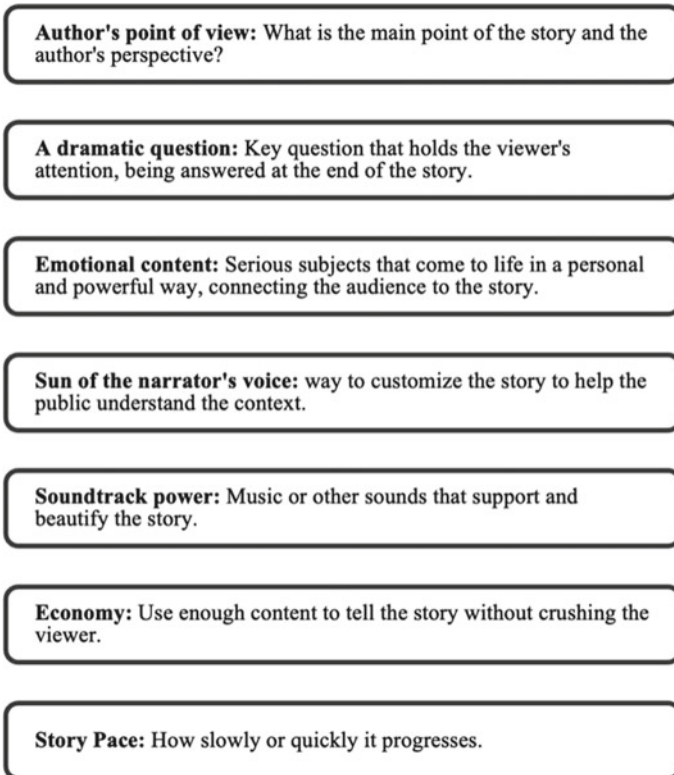

Author's point of view: What is the main point of the story and the author's perspective?

A dramatic question: Key question that holds the viewer's attention, being answered at the end of the story.

Emotional content: Serious subjects that come to life in a personal and powerful way, connecting the audience to the story.

Sun of the narrator's voice: way to customize the story to help the public understand the context.

Soundtrack power: Music or other sounds that support and beautify the story.

Economy: Use enough content to tell the story without crushing the viewer.

Story Pace: How slowly or quickly it progresses.

Fig. 4 The seven elements of digital storytelling from Lambert (1994)

ends up becoming an emotional element in the story. The digital history is saved in digital format, as the name means, to produce video files, if they are uploaded to the web. As is the case with traditional narrative, they contain a strong reflective, emotional and personal component, which implies that the story is quite succinct, usually lasting between three and five minutes [87]. This is because narratives generally revolve around an experience, incident or event called, sometimes, an inflection point, that is, the way the storyteller reflects and interprets the story in concrete, around their own life situation [64].

The strength of DS lies in its simplicity and, also in its accessibility, applying to both the creation and the understanding of stories. The focus is not on technical elements, but on the combination of narrative, audio, and visual elements. Nevertheless, consumers choose to learn about a product/service through videos and not only consider this type of content a form of entertainment given its multimedia capacity [108, 125]. Furthermore, selecting audiovisual elements stimulates creativity and metaphorical thinking, leading to audience engagement and the emotional response [32].

On the other hand, DS is often used as a learning and capacity building tool, promoting critical thinking, reflection and improving writing skills, as well as strengthening relationships between participants and/or vulnerable groups [32, 33]. In the digital world, the ST has played a very important role because, nowadays, people tend to understand better the message that is intended to be transmitted through these media, since the mind already tends to convert reality into stories, making it easier to introduce and to fit into people's minds, so that they can become memorable [100].

The ST has been generally used in the marketing of companies, with the objective of trying to unite and attach consumers to characters and brands, in order to develop business possibilities [115]. However, the impact of ST is difficult to circumscribe, that is, it is inevitable to say that stories enrich content marketing, in addition to humanizing the products themselves through the relationship with customers. According to the Content Marketing Institute, ST is not intended to be a sales tool, but a method of building strong relationships and empathy between the brand and its customers, or a loyal community over time, providing as a basis for content development.

Content Marketing is an innovative approach in the field of marketing, which combines social networks and the practice of narrative, that is, social networks have a communicational function on the internet and ST acts as an instrument for building relationships and interactions. Content that is supposed to be useful to the target audience must meet their interests and needs, as well as add value to the customer [143]. In addition, Hilker [55] defines that the content presented should be mainly informative, stimulating, inspiring and fun for customers, showing that the main characteristic is to add more to the brand, not focusing only on the facts and figures of a particular product. So, to create successful Content Marketing, the content must describe a problem that affects the target audience, followed by a solution to that same problem, which helps the customer to immediately identify with the brand [53].

According to Kartajaya and Setiawan [85] there are eight fundamental steps to help marketers to create an effective content marketing strategy, such as:

1. Definition of goals.
2. Mapping the target audience.
3. Content idealization and planning.
4. Creation of the content itself.
5. Distribution of content across the various platforms.
6. Expansion of content, for example, through well-known influencers.
7. Content Marketing Assessment, through strategic and tactical performance measures.
8. Improved Content Marketing.

In this sense, companies need to define which type of content best fits their goals. The content to be used can include articles, creating blogs, video and streaming platforms, social networks, email marketing, inbound marketing, newsletters, among others. It should be noted that, currently, the main social networks allow the recording and dissemination of videos created by users, called stories, emphasizing the real power of stories, in addition to consumers of stories, users are also the makers of their own stories.

Digital influencers also play a relevant role in DS because they are able to quickly spread messages to large online communities [22, 83]. This kind of content improves the brand awareness and credibility of brands, as well as the emotional bond with their followers [72].

The use of ST in social networks intends to stimulate emotional bonds and should impact, educate, intrigue and appeal to humor [94]. Therefore, the ST of brands should be based on the interests of their targets [115].

Another particularity of the digital environment focuses on the sharing of stories combined with visual elements. DS is very often related with Visual Storytelling (VS). As mentioned by Walter and Gioglio [, p. 7], "the rise of social media platforms such as Pinterest and Instagram, together with the multimillion-dollar acquisition of Facebook, ushered in an era in which the old adage, a picture is worth a thousand words, it is more relevant than ever."

The DS is constantly being reinvented and improved and its purpose is an excellent platform that allows showing the human side of the brand [126]. Sharing online stories can occur on different platforms, i.e., Transmedia Storytelling (TS). Jenkins [66] defined TS as a process in which the elements of a fiction are systematically dispersed, through multiple channels and languages, to create an experience unique and coordinated, in which each medium has a unique contribution to history, influencing the production of communication content, as well as human behavior itself.

So, combining words and VS transforms simple narratives into interactive stories, increasing brand loyalty, generating trust and deeper connection with customers [126]. With the emergence of transmedia in the art of storytelling, Jenkins [66] developed the concept of Transmedia Marketing, aiming to emphasize the customer engagement dimension. Customer engagement tools are important to measure the

reach of communication efforts, such as likes, comments, or any other type of interaction, i.e., indicators of the success or failure of Marketing actions.

Advertising and Storytelling

Marketing communications perform multiple functions and are built in an increasingly challenging environment. The reality of social media has suffered drastic changes and for this reason, brand managers must alternate their communication options to build the BE, that is, choose through a variety of media, if they share common meaning and content, but at the same time differentiate themselves, with complementary advantages [36, 107, 106].

Advertising is considered the combination of information and persuasion techniques and activities and it is characterized as a hybrid form of communication (objective and subjective information) intended to influence the opinions, attitudes, feelings, behaviors and perceptions of the target audience [112].

Using the ST format in advertising texts, as a way of supporting the consumer's connection to the brand, has proved to be extremely effective [, Kaufman 2003). Advertising texts, in this format, can transform information into a condensed and memorable message [7]. This strategy can enable the promotion of social reflections and discussions of consumer interest, thus adding value to the brand [89]. Therefore, stories could inspire and empathically involve the receiver, as well as giving the brand a voice of its own.

However, Escalas emphasizes the positive effect and mental excitement evoked by the stories. Such as Polyorat et al. [121] who corroborate this theory, stating that the ability of stories derives from the mental stimulation of advertising consumption that resides in the way the consumer processes it in terms of decision making. On the other hand, ST is considered an activity and an integral part of what distinguishes us as human beings, especially in a consumerist environment [29].

According to some studies, individuals interpret and they imagine themselves as characters in the story and attribute meaning to them, which indicates that there is a relationship between the narrative and its association with emotional and WOW responses [69]. When consumers understand an ST ad, this interpretation is based on personal information linked to the representations, made by the characters, in the narrative [35]. Naturally, emotions compete a relevant role, providing high levels of consumer involvement [23]. And, therefore, advertisements combine the stories they want to tell with the experiences of consumers, generating positive emotions, leading them to share among themselves.

2 Narrative Construction

It is important to know what makes a strategic story. So, first we must understand what the narrative means. The term narrative has currently reached the height of its popularity in the social sciences. Assuming that, before starting the process of creating a narrative, it is necessary to identify the components that are essential to it,

Message	Conflict	Characters	Plot
• Refers to the central premise or theme throughout the story; • Edeological or moral statement, being expressed metaphorically (Abbott, 2008; McKee & Gerace, 2018); • The story's message does not necessarily need to be happy to induce favorable consumer reactions (Carnevale, Yucel-Aybat & Kachersky, 2018).	• Rupture of harmony and subsequent difficulties that main characters face (Abbott, 2008; McKee & Gerace, 2018); • It is the driving force of a story (Aaker, 2018, Fog et al, 2010); • Although Woodside et al. (2008) state that a good brand story should include incidents that create tension in the audience, Fog et al. (2010) requires a careful balance between harmony and chaos.	• Represent human or human-like entities that are involved in actions or events(Abbott, 2008); • A protagonist and an antagonist can be present as main characters(Dessart, 2018; Fog et al.,2010); • Sympathy and character identification are key to facilitating emotional connections with the audience (Dessart,2018; Mar, Oatley, Djikic & Mullins, 2011).	• It is the causality chair that links the events of a story together (Abbott, 2008; Fog et al.,2010); • It determines how the events of a story unfold, but also provides meaning to the story (Dessart, 2018); • Without a plot, there would be no correlation between the conflict, the characters or the message of a story(Aaker, 2018); • It is concerned with the sequence of events: beginning, middle and end (Booker, 2006).

Fig. 5 Narrative elements

how to define the target audience (segmentation) and the content of the narrative. On the other hand, there are several elements that integrate the creation of the narrative world, including the message, conflict, characters, and plot, presented in Fig. 5.

As a result, brand stories should contain a plot and character elements, in addition to missing any authorship intention, such as a purpose, moral, message or lesson based on a particular context. Taking this in mind, narratives are said to be constructive as they fit into a typical story that includes a collection of interrelated episodes that usually describe sequences of human action. So, narrative thinking must be structured and context sensitive, that is, where individuals end up processing the information received as if they were creating a story, fitting characters and episodes into a narrative envelope, giving meaning to the world and to their lives [12]. Those stories consist of action-result sequences goal-directed, which create responses in the characters, whether physical and/or psychological [118]. As a result of these responses, the characters develop goals that lead to action sequences, which result in certain outcomes, being able to make evaluations and incite judgments when building these same stories [46, 119].

So, the structure of the narrative is composed of two elements, chronology, and causality. First, when talking about chronology, it refers to a certain temporal dimension, something that occurs over time. That is, the human perception of the meaning

of time is accommodated through episodes, but it is an undifferentiated and continuous flow. Therefore, the universal goal of narrative thinking is to achieve the closure of the story, by framing these episodes with a beginning, middle and end [81, 120]. In this way, the real interest occurs when the temporal order of events is clear. It is at this point that the story begins to "make sense".

Second, throughout the narrative, elements and structures are developed, according to the organization, to establish relationships and connections between the narrative elements. For example, first the protagonist feels jealous, next he kills his rival [37].

When developing stories, individuals organize their experiences by creating an order to explain unusual events [26]. Events must be organized based on a chronological order, so that the episodes/moments have a relationship with the entire involvement of the narrative [120]. Gergen and Gergen [46] theorize that the dramatic involvement of a narrative depends on the evaluative inclination of the story, building high and low moments in the action itself.

The construction of the narrative is an excellent contribution in developing the brand identity, but it also proves to be a challenge for organizations because, not all ST examples present a narrative capable of connecting consumers [40, 92].

When creating a brand, the narrative should be the first element to be created and, therefore, starting with a strong, well-designed and quickly recognized personality will strengthen the dependence and coherence between companies' strategies and the perception of consumers [54].

2.1 The Effect of Narrative on consumer's Memory

Neuroscientists have analyzed the effect of narratives on people's brain. Results confirmed an important effect of the narratives [132]. According to Woodside et al. [149], at the individual level human memory is based on the tale. This means that memory is the first indication of the behavior of the storytelling act, in which information is stored and retrieved in the form of stories, sometimes reflecting the listeners/spectators' own lives. Thus, the stories end up awakening implicit and/or explicit awareness, increasing the creation of emotional connections of understanding in them.

According to Fischer [42], at a social level, stories make the lives of each one of us understandable among all. Going against this theory, Boje [19] adds that people end up telling these stories in a conscious way, portraying their own characteristics in the society in which they live. The main purpose of stories makes it clearer and easier to remember certain events that took place in social life, facilitating the transmission of knowledge to future generations [60].

Throughout this process, the associations transmitted by the story persuade the individual and become fixed in his memory, due to the similarities between consumers' thoughts and the narrative. This is consequence of the information received and the experiences lived by each individual, having as a final result,

persuasion, which results from the balance between the strong and weak arguments used.

Narratives can be considered an organizational structure that can enhance consistent memory [10, 147]. Narratives are remembered as abstractions or "skeletons of history". That is, stories help trigger episodic memory, generating multiple associations, judgments and attitudes [135].

In line with this reasoning, a story is much easier to memorize than real and pure information, due to the fact that the human brain is programmed to search for and even retrieve stories that are attractive [149, 151].The narrative appears to be theoretical and relevant, as it helps to recall the brand's elements through episodic memory, providing consumers with maximum pleasure [149]. In this sense, stories can be responsible for the production of knowledge according to their own memorization capacity [153]. One of the basic memory structures techniques is creative memorization, in which each person's imaginations can come to "come to life", in the sense of connecting with something that makes sense, or that reminds them of something. For this, this author resorts a lot to the use of metaphor, as another of the learning techniques in this process, remembering that it is at this point that the real change can happen (Woodget and Channon 2020).

Due to the fact that stories are memorized in different ways, whether emotionally, visually or factually, they are reminiscent of the entire content of the story itself [91]. Due to this natural propensity to think and interpret the world through narrative thinking, this becomes the way of thinking that best captures and calls attention to human intention [37].

In the field of marketing, advertising recall is essential. So, it can be said that the more time the consumer dedicates his reasoning to a particular advertisement, the greater the probability that same advertisement will be retained in long-term memory. Or, on the other hand, when a consumer appreciates a product in a particular advertisement, he or she tries to obtain as much information about it as possible [134]. It is important to take into account the purpose of advertising, that is, if it is to obtain brand recognition, to remember the product/brand or if the consumer arrives at the purchase decision [104]. The literature indicates that the memory of a particular advertisement influences the behavior and, consequently, the consumer's opinion, explaining why the message content and the advertising structure are key [134].

3 Conclusions

Very often, consumers involvement is considered a moderating effect of the consumers decision-making process, based on their needs, interests and values [18, 124]. Together with this involvement, there is a growing recognition of the role that emotions play in the building of brands [31, 51]. Stories are an effective way of providing an approximation to the consumer's identity, which means that there is a connection between the consumer and the brand. Consumers exposed to a narrative

process are more emotionally connected and are able to identify and recognize themselves in the brand, impacting their own attitude towards it [91, 95]. Consumers are looking for experiences that appeal to their emotions and dreams, so stories support the reach of these experiences, increasing trust in the brand, as well as its recognition, awareness and uniqueness [91].

Organizations should create their own stories because narratives stimulate different emotions in consumers [49]. The use of ST allows for better interaction and integration of brand values compared to the more traditional forms of communication used by marketing [54, 109]. Furthermore, brands also provide sensory stimuli, invoking positive or negative feelings, playing with consumer's specific state of mind especially when they engage in an egocentric way with the brand [136]. In line with this perspective, Escalas and Herskovitz and Crystal [54] refer that ST positively strengthens emotional connections with brands.

As a result, emotional branding is primarily consumer-focused and characterized by relationship building, a story-driven approach that leads to deep emotional and affective promises between the consumer and the brand [128]. The affectivity created by the ST is perceived as a process with relevant opportunities to improve consumers' loyalty. So, affective involvement increases levels of commitment to the brand and, consequently, a willingness to pay a higher amount for the product [123].

Thus, the more inspiring and emotional the story told by brands, the greater the emotional connection established with the public [39]. Theoretically, the customer engagement and emotional reactions to brand narrative ads can be explained by two complementary mechanisms—narrative transport and empathy for the characters [96]. Narrative ads are generally more persuasive and remind more favorable cognitive and emotional responses than non-narrative ads [82]. The explanation for these events lies in the fact that human beings think in a narrative rather than an argumentative way [101]. In addition, due to the episodic nature of memory, consumers tend to remember stories better than facts or product features, which enhances brand recall [82, 90]. Narrative can help marketers to create emotional bonds between consumers and brands and, in this way, facilitate the resonance of the same [4, 149].

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Dynamic Visual Identities: Reflection on Interaction and Playfulness in Visual Identity Design by Porto Design Studios

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Abstract This paper is a part of an ongoing research conducted by the authors. As a primary effort of a bigger study, it aims to grasp a correlation between dynamic visual identities and contemporary society, considering the concepts of liquid modernity [1], mindfulness [2], playfulness [3] and relational design [4], among others. Some brands—particularly a sample of contemporary DVI's from Porto Metropolitan Area's design studios—are verified and analyzed through a condensing terminology, from Kopp [5], Kretuz [6], Olins [7, 8], Marriot [9], Nes [10], Oliveira et al. [11] to Lelis [12] and Martins et al. [13]. As methodology, we collected important references from literature review on several areas of study and some qualitative content visual analysis of dynamic visual identities from Porto's graphic realm—our city's design studios. As value, originality and motivation for this research, we advocate that DVIs do not seem to be taken into account by much of the scientific research in our field of expertise in our country, apart from certain authors that we refer to. We seek to share with design students and brand managers alike, the playful connections the design of a dynamic visual identity can have through a reduced attention span, that the fragmental media and capitalized culture have provoked. As a result of this exploratory research, we accomplish a preliminary contribution to the recognition of Portuguese DVIs, markedly from Porto graphic design studios—and critically reflect about how they are moving in that direction, discussing the benefits and consequences of play in DVIs.

Keywords Visual identity design · Dynamic visual identity · Play · Liquid modernity · Porto design studios

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1 Introduction

In our contemporary liquid modernity [1, 14], visual identity systems suffered a great transformation in perception and seek to break through a collective reduced attention span [15]. The transition to a participatory culture fragmented them, through multiple digital communication devices. Contemplating the interactive reality and willingness to participate in society, brands found themselves in the need to be more than mere labels and to feed themselves in a universe that expands in games, films, TV series and extends into the virtual sphere. In view of these demands, the graphic representation of the brand needs innovative solutions. Integrating meaning into the human experience through design seems, in fact, to have become one of the greatest ambitions of designers' practices in recent decades.

We will reflect on interaction and playfulness in visual identity design as a change in graphic solutions, increasingly manifested through the blurring of boundaries between emitter and receiver, author and audience, playfulness, function, technology, and discuss, critically, the benefits and consequences of the relational and play qualities for visual identity design. Chronologically, we will contextualize the theme from the democratic arouse of Internet (during the 90's), until we contemplate the interactive reality and the willingness to participate, in today's society.

Through this research, we aimed to start to make a literature review connected to contemporary visual identity design, particularly into the Portuguese graphic design context from Porto Metropolitan area. To this study—which is part of a larger and more complete research—we considered some visual identity projects from studios based in that location as an exploratory survey. Thus, since the training of the authors was in Art and Design, this paper is part of an ongoing research, which brings together the playful, participatory and relational dimension subject study [16–21] with the visual identity design system scientific field [22–25].

In order to describe the characteristics of the DVIs and to demonstrate the (co)relations between playful visual identity designs made in Porto area and contemporaneity, we established literature review on the topic of *visual identity design*, supported by other researchers, particularly Olins [7], Kopp [5], Marriot [9], Nes [10], Kreutz [6], Oliveira et al. [11], Lelis [12] and Martins et al. [13], on *liquid modernity* [1], on the *collective reduced attention span* [15], *mindfulness* [26], *hypermodern ludicity* [27, 28] and *playfulness* [3], Callois, [29], on *emotion* and *relational design* [30, 31, 4] to ground a theoretical foundation for our study.

We proceeded with a qualitative content visual analysis [32] in light of a post-positivist perspective, which embraced subjectiveness and imprecision, aligned with the concept of a *liquid modernity* and fragmental points of view [1], in order to allow a multitude of empirical and conceptual interpretations resulting in a broader understanding of the phenomena, with the intent of generating more questions for further research and for academic debate.

Firstly, we will present the theoretical background and literature review in detail. Afterwards, we review the importance of the use of emotion, relational design and play, into this design sphere of building DVIs, in light of the concept of a reduced

attention span. Latterly, we analyze critically, the results found from the operationalization of our methodology. Lastly, we present the final considerations and future outputs from our study.

2 Visual Identities from a Solid to a Liquid Scene

In addition to the technological, social and cultural paradigm shifts in the context of designing a new visual identity, the zeitgeist in which the design activity operates, contemplating not only the technology used to operate and to produce visual identities, but also the technology used to experience them within itself it changes, so the flexibility of the visual identity system is to be considered [33]. Moreover, a conventional, static visual identity may develop in its applications and chronological evolution into a DVI, just as a DVI may have to have one or more conventional, static solutions to respond to the communicational requests of the various media. This fragmentation or multiplication of DVIs may have to be tamed or controlled when migrating to other supports or other mediums and might also have to be drawn in a more conventional way in order to fulfill other purposes and programs that may arise.

Here we used the term DVI, but we can find several terminologies utilized by different authors: some researchers call them *variable* [5], others *mutant* [6, 34], *flexible* [35, 9, 36–38] *open* or *fluid* [39, 40], *dynamic* [37, 41, 10, 42, 43, 13], *mutatis mutandis* [23], *logomorphism* and *liquid* [44], *elastic* [45]. Additionally, there are different types of DVIs and authors classifications differ as compiled by Martins et al. [13]. For instance, Nes [10] refers to DVIs in six classifications: *container* (there is a constant shape or typography within which there is variation, for example, in MTV, the characters M, T and V function as a window to multiple textures, colors and movies), *wallpaper* (DVIs where there is a flexible background of images and textures on top of which the fixed logo is juxtaposed, as in AOL by Wolff Olins), *ADN* (there are different shapes that clearly belong to a system and share the same principles, for instance the visual elements of EDP, by Sagmeister&Walsh: this DVI is, according to Oliveira et al. [11], a combination of the abovementioned classification of *wallpaper* in the fact that the logo is stable in front of varying shapes, and the classification *ADN* in the fact that those shapes share the same color, transparency and geometry), *formula* (there is consistency in the several combinations of elements of the visual system, given a common code, as in Google), *customized* (there is interaction and adaptation to user-based changes, such as in 180 Creative Camp by studio Degrau), and finally, *generative* (there are modifications that are algorithm-based, as in Edit, Disruptive Digital Education, by Volta). Kreutz [46], on the other hand, subdivides DVIs (which, as we saw, she calls *mutant*) into two categories: *programmed* (changes follow a preestablished set of rules, resulting in a restricted number of variations) or *poetic* (where there are virtually endless solutions). On the other hand, Martins et al. [13], analyze DVIs through the combination of dynamic versus static elements in *visual identity focus* (whether in the logotype, graphic mark or tagline), *variation mechanisms* (such

as in *color variation*, *combination*, *content variation*, *positioning*, *repetition*, *rota-tion*, *scaling*, *shape transformation*),and through their *features*, classifying them as *flexible* (there are different results in adaptation to different outputs), *fluid* (the DVI is animated and conveys movement, such as The Form of Form, by R2 or André Dias Araújo by Another Collective), *generated* (there are algorithm-based modifications, such as Edit, Disruptive Digital Education, by Volta), *informative* (there is adaptation to portray parallel information, such as in C. M. Aveiro by Providência Design, or Porto. by studio Eduardo Aires), *participatory* (there are user-based modifications), *reactive* (there are external data-based changes, such as Troll by This is Pacífica), and finally *unlimited* (DVIs where there are endless variation possibilities).

Despite these different terminologies and classification categories, there is, however, consensus in the sense that there are static elements in a DVI that maintain its visual system's integrity, graphic equity and recognition of a visual family, and variables, which convey the dynamic element to the DVI.

Says Kopp [47] that debates about the shift in the zeitgeist of visual identity design can be seen back in 1996 with Lupton and Miller [48], as well as at the turn of the twenty-first century with Cauduro [49], Gruszynski [50], Kopp [5], Poynor [28] and Bomeny [51]. A shift that we consider inside de relational design concept as it was proposed by Blauvelt [4].

2.1   A Relevance of Play, Emotion and Relational Design

In a world where everything stimulates us with seductive, increasingly sophisticated strategies, attention is saturated, fragmented and numbed, resulting in a reduced attention span [15], propelling us to automatic and visceral responses. What characteristics have developed in visual identity design to install a synthetic message in the memory of this, almost constantly, distracted audience? In fact, within the relational approaches to design, a list of terms has emerged to classify DVIs that involve similar issues, such as stimulation of emotions, empathy, collaboration, dynamism, interaction, or experience.

To support this reflection, we call for the investigation of Ellen Langer [26, 52], a scholar of positive psychology in Harvard, that has focused for several decades on issues related to attention and awareness. It contributed to the recognition of the concept of *mindfullness* (active awareness), a growing term in psychology in the 90 s, and currently a popular term. According to this scientist, it is in the idea of *certainty* that we find a lack of awareness or *inactive attention.* This means that when everything is believed to be known, little attention will be paid by our brain. We will have the same question addressed by authors like Csikszentmihalyi [30] and Donald Norman [31] in the thesis that the dynamism of the experience lies in the incomplete, in what is required by the viewer to be understood or filled out. Active attention is encouraged by demand and by a certain degree of dissatisfaction, and this factor indicates the importance of a dynamic experience in an engaging relationship.

The nature of the interaction is experience, therefore, it is relevant to create design solutions that activate attention and a continuous interest.

We know that visual perception is a cognitive process determined by the memory of previous experiences [2]. Hence, if a DVI is characterized by the changeability of its visuals, the cognitive process demands a more complex interference of memory. In other words, memory is requested more frequently, resulting in a more complex neurological process of experimenting, and observing a DVI. Consequently, to perceive changes as such, in the visual appearance of each graphic solution of a DVI—be it macroscopically, in correlation to the whole visual narrative of the identity in a holistic way, or microscopically, to a previous keyframe demonstrated in a motion form of a DVI animation—incitement of memory, arousal of emotions and the element of surprise (which is linked to consistency in a rhythmic way) are vital elements [6, 23, 53].

Psychologist Ellen Langer concludes that achieving active attention is not easy, "we need to break through established patterns of perception and experiences (…)" [54], p. 8. In other words, there must be a disruption, which can be facilitated by external agents incorporated in the design. Nevertheless, the relational design in a playful approach, imposes certain rules in a particular time and space. Seemingly opposed ideas appear to be defended, such as dynamics (of the experience) and durability (of memory), uncertainty and guidance. Paul Rand, for example, in his text Design and Play Instinct [55], already referred to the pertinence of using game principles—the existence of limits defined by a discipline—as one of the most important aspects for the motivation and creation of new, meaningful solutions by the designer.

The concept of game and play is understood here as a phenomenon of cultural significance, based on the theories of Johan Huizinga [3] and Roger Caillois [29], which marked this dimension. Although these authors do not consciously analyze the playfulness in design, they approach cultural manifestations in a broad sense, allowing us to make this approximation. Here we can find an important similarity between games and relational-based design projects. Both "introduce[s] temporary and limited perfection into the confusion of life and imperfection of the world, demanding a supreme and absolute order: the least disobedience to this 'spoils the game', depriving it of its character and of any value" [3, p. 13].

Thus, the existence of rules and systematic approaches, such as constraints in color palette, in use of fonts, in use of families of geometric shapes, or in visual language, are fundamental to guide the viewer of DVIs through its many variations. Otherwise, the complexity and difficulty in grouping the variability to one cohesive visual narrative would leave the viewer adrift. More than informing how to experience it, and promoting certainty and rigidness, design should attract the audience to a process, that is, to the playing arena.

In the cultural and social context where interactivity is an attraction and culture is participatory, the design that is now taking place in an *expanded field* [56], has shown a growing interest in the involvement of the recipient and a commitment to mobilize it, resulting in the emergence of projects of a relational, dynamic and emotional nature that change appearance or that move through time. In this sense, the relevance of the new approaches to design has been argued as being a way of facing

a constantly changing environment: "the challenge is not how to design a response to a current issue, but how to design a means of continually responding, adapting and innovating." (Burns et al. p. 21, 2006, Cit. By Sangiorgi [57, p. 29]). It is essential to reinforce that we live in a fragmented communication environment, without the old hierarchies in which the audience moves with a new libido—the desire to be a producer [58].

The relational-based proposals, which develop with a hybrid, experimental and dynamic character, have intensely explored the unpredictable nature of the audience's behavior and involvement. In fact, the idea of the independent designer of a commercial relationship, which develops as an author and producer, finds in human availability a raw material on a completely new scale. This reality has made it possible to develop and apply participatory methodologies, in which the process and the performance activity are more relevant than the final result. In those design approaches, the designer becomes a kind of co-interpreter, determining the structure and rules, as if it were a game. As an example of this decision, there are participative DVIs still with few examples in Porto area. One such case is Câmara Municipal de Vila do Conde's visual identity, which empowers each user to make the brand their own by writing the user's name; there is a specific visual result for each character digitized by the user, that has the same lexicon of shapes, colors and grid as the main visual identity of CM Vila do Conde, conceding it flexibility. It is, however, confined to a small space on the CM Vila do Conde website without much visibility for wider use. However, access to participation through recreational moments, pleasure and immediate stimuli, does not necessarily imply symbolic depth, nor the experience of an effective 'experience', as discussed in "Play as a trigger for designing significant experiences" [21]. The playful element is commonly used in the creation of pleasant experiences, but eventually superficial and fleeting. According to that paper, several studies show that the greatest emotional reaction is triggered by less expected events, as opposed to familiarity, which tend to reduce the user's reaction and attention. Donald Norman [59] also concluded that good design solution (or a visual identity with high communicative potential) is one that takes into account the dynamism of the experience. In other words, it is a solution that is moderately revealed (it is not immediate, not revealing everything at once), so it has the factor of surprising and generating enthusiasm. In this process, the subject becomes part of that game, to which he/she voluntarily dedicates. A solution that provides a dynamic experience is one that, contrary to the fast-paced speed we live in, is durable. That is, it resists time due to its capacity for seduction, moving away from neutrality, normality or familiarity. In other words, the design solution must continuously feed the user's interest [31].

For the designer Jeremy Girard [60], the playful element is fundamental in the communication experience. However, according to him, this factor will only become memorable if the amount of humor is added in the correct proportion, otherwise it can be an obstructive element to the rest of the experience: "too much can have

the opposite effect, driving users away due to an over-the-top approach". As a well-resolved example of this situation Girard points out the Google logo which multiplies the 'o' for the 'more results' button. The fun factor never compromises the access to the service itself.

3   Porto Studio's DVIs: Exploratory Research

Our profession as Polytechnic teachers and as researchers in higher education design courses, and as communication designers ourselves, has been developed in northern Portugal. Our geographic context was important as we seek to be aware about market communication, and we wanted to think globally and interact locally. For the development of this research, we first defined the sampling criteria to be our area of expertise, located in the site of Porto city area.

For this first approach we started by contacting some design studios, via telephone and email, without differentiating the more established studios from the most recent ones founded by younger designers.

In this framework, we selected, from their online portfolios and by direct contact, freelance designers and design studios located in Porto Metropolitan Area that developed visual identities. Through this process of visual analysis and interviews, we were able to collect studios that had designed and implemented DVIs.

4   Analisys

As stated, we found redundancies in the terminology used by the several authors analyzed [46, 37, 10, 42, 40, 43, 34, 13], so we simplified the categorizations and analysis factors of the DVIs in order to result in students' awareness and empowerment through pedagogical knowledge.

This preliminary study, part of a bigger research, supported us to critically suggest that there are mainly three types of DVIs in Porto design studio's activity: (i) DVIs which have movement or animation, (ii) DVIs with an interval of solutions recreated and recombined almost endlessly by the design studio; and (iii) DVIs that are generative, where there is coding involved, allowing adaptation either to external or user-based modifications, even though few examples have been collected.

As an example of the first classification (i), we can mention DVIs such as *Playground*, by This is Pacifica; *180 Creative Camp* by Studio Degrau; *The Form of Form* by R2 Design; and *André Dias Araújo, Arquitectura e Design* by Another Collective. For the second classification (ii), we can mention DVIs such as *Câmara Municipal de Aveiro*, by Providência Design or *Porto Ponto* by Studio Eduardo Aires. And, finally as an example of the third classification (iii), we can mention *Edit* by Volta. Other designers, for instance, Luís Cepa referred the fact that they were working

on generative DVIs using, in this case, Processing and P5.js, but were still under construction.

Next, we highlight one example per each category.

4.1 Movement or Animation

The Form of Form, by R2. Invited by R2, Henrik Kubel designed new glyphs for the F, R and M and the letter O is reshaped in a variety of squares and rectangles, generating a dialogue between different spaces, just like the intent of discovery and debate construction around architecture, around its visual dimension, social and technical impact of the Lisbon Architecture Triennale. The logo animation is portrayed in suitable new media (Fig. 1).

André Dias Aquitectura e Design, by Another Collective, is an Architecture and Design Office. The DVI is characterized by simple, continuous morphological variations of the letters A and D that define de acronym, supported by neutral sans-serif typography that has no variations, other than its location in relation to the acronym. Similar to the studio's adaptations to the programmatic variety of its projects, the DVI shows flexibility in the scale variability and form of the line, resulting in fluid motion (Fig. 2).
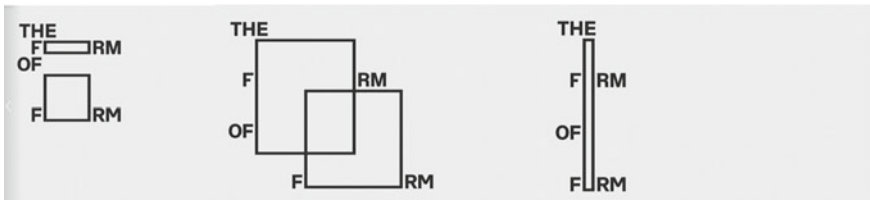
Fig. 1 Frames from The Form of Form, Lisbon Architecture Triennale, by R2, 2016. Website R2: www.r2design.pt
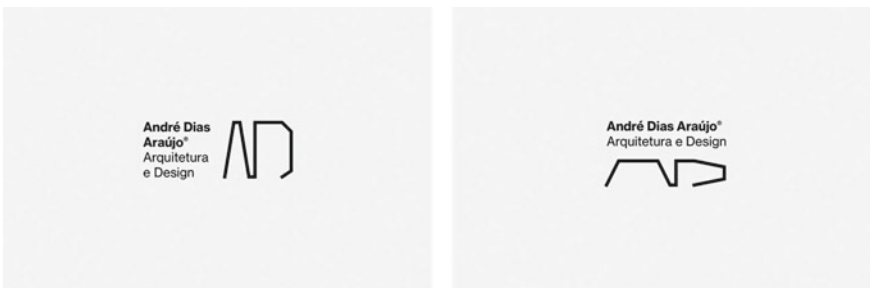

Fig. 2 Frames from André Dias Araújo Arquitectura e Design, by Another Collective. Another Collective website: anothercollective.pt

4.2 DVIs: Interval of Solutions

Câmara Municipal de Aveiro, by Providência Design, is an institutional DVI with variants introduced to distinguish the entity's multitude of services. The typography is static, the iconographic variations are framed in a fixed grid that can be filled in different positions depending on supports, media outputs and informative purposes (Fig. 3).

Porto. by Studio Eduardo Aires, has a static logotype, surrounded by variability in its iconic system and its position inside the grid that the studio has structured. This system is inspired by Porto's tiles and informs the user of the C. M. Porto's stories or services. (Motion can also be present in suitable media by animating the icons' lines.) (Fig. 4).
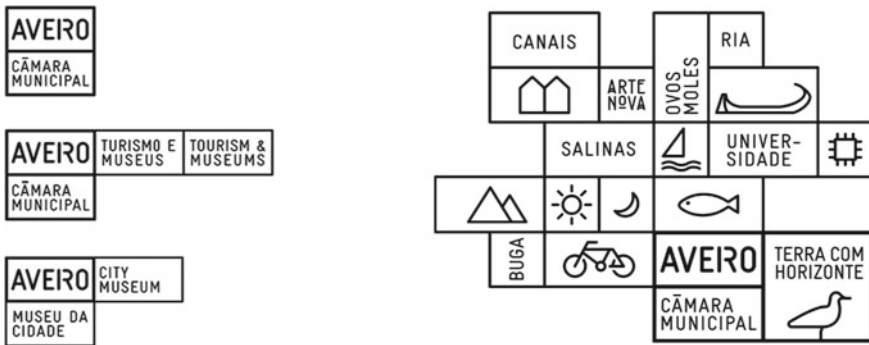
Fig. 3 Câmara Municipal de Aveiro, by Providência Design, 2017. From Brand Identity of Aveiro (CMA). Providência Design website: fprovidencia.com

Fig. 4 Porto., by Studio Eduardo Aires. From brand identity of Porto (CMP). Studio Eduardo Aires website: eduardoaires.com
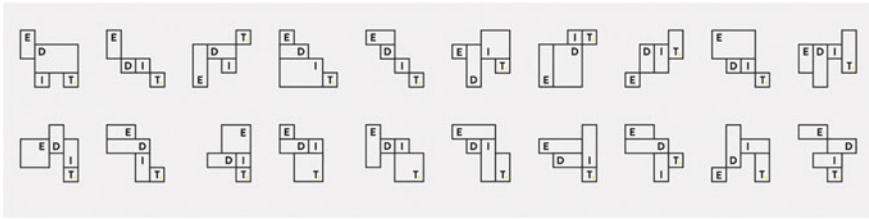
Fig. 5 Frames from EDIT Disruptive Digital Education, by Volta. Volta Brand Shaping Studio website: volta.pt (https://volta.pt/pt/edit-pt)

4.3 DVI: Generative

Edit, Disruptive Digital Education, by Volta. In a 4×4 grid, each square represents the pixel, framing each letter of the word EDIT. The combinations of frame sizes and positions are endless, portraying a digital attitude for this school on digital design, marketing and creativity. The logo, albeit static in typography, is variable within the structure of its grid (Fig. 5).

5   Conclusion

As a result of this exploratory study, we are able to observe the following:

(a) a sample of the contacted Porto Metropolitan Area design studios were unsure of the scope and definition of a DVI;

(b) there are fewer examples of DVIs based on generative solutions, of participative or reactive nature, that use the context of the user to feed the code constraints and conditions that were used to design them. However, as stated earlier, there are cases of generative solutions still in the making, some of them through software such as Processing and other coding languages (for example by designer Luis Cepa or Francisco Providência), that haven't been implemented yet or are still in the process of a graphic competition.

(c) most of the collected studios' DVIs seem to take hold in an interval of options designed by the designers, that can be rearranged in a virtually endless way.

(d) we also found that it is mainly the younger studios analyzed from our sample who have experienced more on DVIs, in contrast to studios that have been established for a longer period of time.

This research, speculative in nature, analyses DVIs with the intent of studying and describing the characteristics of this type of visual phenomenon and playful interaction with technology and the user's emotions. The case studies presented here had no intention of making universal or dogmatic generalizations, nor to state that DVIs are in any way better than conventional visual identities. Nevertheless, our

endeavor by using this approach and methods, was to contribute to a new vision on DVIs, through the perspective of playful, emotional and relational interaction that describes a new social and technological zeitgeist and raises design students' awareness on these intertwined topics.

We are living in a moment that might correspond to a recent openness, by designers and their studios, to this trend of DVIs. This situation may also mean that, in terms of design education, there is still plenty of space to create relationships between the most conventional and classic graphic design courses with the information and communication technologies and digital processes. As teachers, we can witness that this interconnection in higher education already exists, but there may be space to strengthen this multidisciplinarity in the academic project and in the structure of pedagogical design programs in the metropolitan area of Porto.

Along with humanity's evolution, technology and the way in which we communicate, have evolved tremendously, at an incomparable speed that hasn't corresponded to the velocity in development of our brains and emotions. This new technocratic, globalized world we live in, craves for attention from our optical systems that are, by and large, overloaded. Analogous to our cerebral processes which are configured, in striking similarity, to the ones of our ancestors, which helped us fight or flight from our predators, we are suffering a dramatic reduced attention span due to excessive visual requests.

Nonetheless, it seems our brain is aligned to engage in a more complex way to the presence of play and movement, be it real or perceived as such, due to animation or changes in composition, color, content, morphology, in a DVI, and consequently, be aroused by the presence of one. DVIs show playful features, evoke memory, provoke emotional responses that help establish a relationship and identification with its hypermodern situated audience. Studies in the scientific fields of psychology are, for this reason, fundamental added contributions to instruct communication designers with scientific arguments, safeguarding, however, the importance of their sensitivity and intuition when designing a DVI.

We can also verify that velocity in mutations, characteristic of today's cultural, political, societal, economic sectors we live in, is mimicked and reflected by a dynamic, playful visual identity, of a DVI. These features seek to stay adequate to the varied circumstances their target audience lives in, that doesn't abide by controlled or strict rules that can be frozen on a conventional manual of norms. These rapid advances in technology are also the reason why it is even possible to accomplish the design of recent DVIs. Much like a gesture in a person's identity, dynamism can be also a low-tech feature, similar to color, that adds a new characteristic to a visual identity.

Aspiring designers and design students should be aware of this lifting of technological constraints, beyond conventional graphic design rules and education and be open to design with animation, movement, coding and algorithmic, generative, participative or reactive nature: allowing a flexibility in their design of visual identities, in order to potentially predict their relevance in polysemic and pluralistic needs, purposes, audience expectations, and desires of interaction.

If it is true that levels of elevated arousal—such as the ones resulting from the mutability of a DVI and the consequent superior request of memory to perceive those changes as being part of plural solutions within one same visual identity narrative—it can improve engagement, then it is only safe to say that DVIs constitute an enriched cognitive mechanism with the viewer, transforming one's perception in a subconscious way. In other words, a playful strategic is a manner to obtain engagement and interaction with the audience.

For Brand managers and design students alike, the challenge is to acknowledge that dynamic experience held by DVIs can surprise and delight through an unexpected added image, an added texture, an added position, location, form, color, typography, composition, rotation … Indeed, an unexpected new graphic solution, indelibly engraved in the memory of those who participate in their interpretation, and thus construction, and should go beyond craving for the user's attention in a gratuitous manner. In consequence, engagement is held internally, but never neutral. In other words, the communicative power of a design solution is in the activation of the user's emotions, retrieved by the associations and memories that are evoked during the moment of interaction through the design.

Therefore, more than dictating prescriptions, we were successful in observing different examples on how to promote experiences through visual identities that guide, both author and receiver, through constraints that are to be played out almost like a game, but convey rhythmic and consistent solutions for a given communication problem of identification.

This preliminary research gave us a perspective on the importance of investigating more on the topic, that does not seem to be taken into account by much of the scientific research in our field of expertise in our country. We concluded that it is still a very much fresh subject in our area of expertise and influence: both lacking a full body of scientific writing and a full tangible implemented design work through most of the studios. Some of the contacted Porto design studios were unsure of the scope and definition of DVI. As we have seen, there are few examples of generative, participative, and reactive DVIs designed by Porto area studios. Processing technology, such as P5.js is beginning to be a technology that is starting to be used by young designers, but as abovementioned, this identity in motion and play can be a low tech feature, adding complexity, depth and emotion and, as consequence, memorability and uniqueness to a visual identity.

As limitations, not every studio replied to our contacts, and by constraints of time and lockdown due to Covid-19, we were able to analyze in detailed form just a portion of the visual identities from the studios in our study collection. Our aim, however, was not prescriptive or universal in any way, therefore, we hope to motivate further investigation, and this will be our starting point for future developments on this topic in our area.

With this research, we believe we have contributed to the communication of such a synthetic design as the visual identity, in particular DVIs from Porto Metropolitan Area. Although preliminary, this research served to observe the pertinence of the theme in the national context. In future studies, it will be important to gather and analyze a greater number and variety of DVIs with common lines of action—in

which the design is mediated by playful, participatory and relational factors—in order to establish a new grid of meaning in the creation and development of the graphic identity, examining DVIs reception from its audience and scrutinizing if there is a perception, both by its viewers and its creators, of the playful qualities of its mechanisms of variation.

Finally, if we consider the existence of rules and systematic approaches fundamental in the design experience and in the playing arena, where conventional or unconventional visual identities live, contacting and touching those around them, we are certain that the current pandemic context will have a strong influence in the way brands will communicate in the near future.

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Developing an Integrated Communication Plan in the Digital Age

André Teixeira, Sergio Dominique-Ferreira, Nuno Martins, and Cristina Sylla

Abstract Marketers are constantly exploring the best communication channels to deliver the best possible message to their targets. Therefore, technological advances are continuously shaping communications, especially in digital environments. Bidirectional and interactive dimensions characterize digital media communications. This study explores relevant literature on integrated marketing communications and communication in digital environments, including child-oriented marketing communications. As a result, theoretical framework on digital communication is provided for academics and practitioners.

Keywords Digital marketing · Integrated marketing communication · Digital communication · Business-to-business · Business-to-consumer · Child-oriented marketing communication

1 Integrated Marketing Communication

Advances in information technology and the consequent expansion of new digital media have brought new possibilities and perspectives to modern marketing and have made the management of marketing communications much more complex and

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challenging [1]. According to the American Association of Advertising Agencies (4As), Integrated Marketing Communication (IMC) is characterized as:

> A marketing communication planning concept that recognizes added value in a plan that integrates a variety of strategic disciplines, for example, general advertising, direct response, sales promotion, and public relations, and combines these disciplines to provide clarity, consistency, and maximum communication impact. (Shultz p.13, quoted in Amanda Zwerin et al. [2])

Nowadays, marketers are continually testing different communication channels to develop an effective communication. The reach of the message has become a key element of the best marketing practices, helping the companies to meet their goals and increase their value [3]. Hence, IMC strategy consists of analyzing, planning, and aligning the communication of the entire company, improving the impact of each communication channel. Its primary goal is to build long-term relationships between members of the organization and its customers [4, 5]. Consistency between messages sent through different channels as well as the consistency with previous messages are crucial [6].

Therefore, organizations are increasing their advertising budgets to prmote their products and services on social networks, developing a competitive advantage [7]. To date, traditional IMC consisted of a few popular tools, such as advertising, sales promotion, direct marketing, and public relations, which are not fully effective in researching and evaluating the differences of Generation Z [8, 9]. Consequently, digital marketing and social networks must be integrated into traditional IMC tools to obtain a fully updated tool for the challenges of technological innovations [10].

As a result, it is expected that in the near future, marketing communication will undergo constant changes due to the development of technology, which indicates that new studies and research should be carried out for continuous growth and alignment with marketing objectives in order to reveal, the true effectiveness of a IMC strategy [11]. In this sense, the originality of this study is to further explore IMC, trends and child-oriented marketing communications.

1.1 Integrated Marketing Communication's Strategy

Currently, with the new communication´s environment, marketers should be able to structure IMC plans. In this sense, they should start having a clear understanding of the functioning of all the different types of communications, as well as the process and consumer buying decision process [1].

The development of a IMC plan sets the basis for the implementation of integrated marketing communications in organizations [12]. According to those authors, the IMC plan coordinates the components of the marketing-mix to achieve harmony in the messages sent to consumers.

Clow and Baack [12] suggest dividing the analysis into two steps (see Fig. 1). First, it necessary to carry out an analysis of the current external and internal environment based on primary and secondary data. Next, marketers should develop a

Fig. 1 Plan steps IMC [12].
Source Own preparation adapted from Clow and Baack

SITUATIONAL ANALYSIS

SWOT ANALYSIS

MARKETING OBJECTIVES

TARGET AUDIENCE

MARKETING STRATEGIES

MARKETING TATICS

IMPLEMENTATION

PERFORMANCE'S EVOLUTION

SWOT analysis, analyzing the elements present in the internal and external environment of the organization. This includes: the identification of the company's strengths and weaknesses (internal analysis), opportunities and threats (external environment). Subsequently, the definition of marketing goals should be suggested. Defining the primary goals of marketing communications enables companies to define different types of goals, e.g.: higher sales, increase in market share or a new competitive positioning. Those objectives must be related to the main target of the company. Therefore, the fourth step is related with the identification of the target(s). Based on the outlined marketing objectives and the selected target, the fifth stage concerns the development of the marketing-mix. Defining strategies should include the marketing-mix, brand image and positioning tactics, differentiation, and brand information. The tactical communication plan is the sixth stage of this model, aiming to support the required actions of the marketing-mix. The final two steps in the marketing plan are: (i) operationalizing the plan, monitor the performance of each element. Next, the budget and schedule of the IMC plan must be defined. The last stage of the model consists of its evaluation and control.

1.2 Tools for Integrated Marketing Communication

Technological developments changed the way companies and consumers communicate [1]. Over the years, promotional elements have included advertising, sales

promotion, and personal selling [12]. Furthermore, other advances such as: data analytics, e-advertising, digital marketing, direct marketing, social networks, public relations, play an important role in the development of communication in digital environments.

As mentioned by Key and Czaplewski [13], advertising consists of the development of any message, reminder or persuasion directed at a target market or audience, usually carried out in a generalized, non-personal way, and identified by a specific sponsor. Television, radio, newspapers, magazines, and billboards have long been some of the traditional advertising media [12]. In the current digitalization age, the dissemination of advertising is much faster and more effective, leading to the transmission of a more segmented, interactive, and responsive message [14]. Marketers can use their digital assets through bidirectional and interactive communication, namely digital media a part of the Digital Marketing. Digital marketing includes email marketing, websites, blogs, APPs [12].

Networks are extremely important as they influence users' social perception and behavior [15]. Compared to the more traditional communication channels, social networks are more persuasive as they allow consumers to express their satisfaction with product [16, 17]. Surprisingly more than 90% of companies use social media platforms like Instagram, Pinterest, Twitter, LinkedIn, Facebook, YouTube, WhatsApp, Tumblr to increase brand awareness and attract new customers [18, 19]. Social networks facilitate the location, measurement, and analysis of online strategies, allowing companies to draw conclusions and adjust strategies rapidly [13].

Traditional advertising has almost always faced several communication challenges and as such, new approaches have emerged that establish the fundamental basis of alternative marketing, such as buzz marketing, guerrilla marketing, product placement, branded advertising. entertainment, and lifestyle marketing [12]. Organizations identify new opportunities in the customer's purchase path. Therefore, companies should prepare their marketing messages to draw attention to these touchpoints, providing a complement to mass media and digital advertising. Carrying out a guerrilla marketing campaign can also include elements of buzz and lifestyle marketing, thus showing versatility and synergy between different alternative marketing programs.

In this context, Data Base Marketing (DBM) plays a vital importance and it defined as the process of building, maintaining, and using databases of customers, suppliers, or resellers, with the purpose of creating contact, relationships and carrying out interactions or transactions [20]. In the same line, Clow and Baack [12] refer that DBM consists of collecting and using customer data to improve interactions with the public to achieve customer loyalty. Data warehouses, data encoding, data mining, are some of the DBM program, allowing companies to better know their targets, which can make message dissemination more effective [13].

Direct Marketing consists of directing products to consumers, not using other channel or intermediaries [20, 12]. While advertising consists of non-personal communications, direct marketing seeks to create individual personal relationships with the target audience with the main objective of acquiring responses [13]. In direct marketing, organizations have the possibility to use certain channels to reach

consumers, such as direct mail, direct email, catalog marketing, search engine optimization (SEO), Inbound and Outbound telemarketing, interactive television, websites, and mobile devices [12, 20]. In the current digital technological age, companies are increasingly using mostly direct communications with their customers [21]. Textual paralanguages include the use of visual, audible, and non-verbal elements that usually replace written language with symbols, images (e.g.: emoji's) [22]. The existence of databases is what allows direct marketing to be carried out, which is a way for companies to better know their customers [13, 20], specially through DBM.

Consequently, Clow and Baack [12] refer that personal selling is an opportunity to build long-term relationships with consumers. Personal selling is one of the best techniques applied to convert the preference of the audience's behavior,however, it depends a lot on other elements of the communication mix. Personal selling efforts cannot be optimized without the existence of direct marketing, database support and advertising dissemination that creates awareness and knowledge about a certain situation otherwise, personal selling is likely to be lost [13]. According to Clow and Baack [12] the standard steps of a personal selling process consist of lead generation, lead qualification, knowledge acquisition, sales presentation, handling objections, closing the sale, and customer follow-up.

The public relations department manages advertising and other communications with all groups in contact with the company, with many of the functions being similar to those provided by the marketing department [12]. Subsequently to Kotler and Keller [20], public relations offer several options to promote and protect the image of a company or individual products, including company's newsletters, internal messages, public relations communications, correspondence with shareholders, annual reports, various special events and social networks. Public relations work closely with the other elements of the marketing mix in an integrated way [13].

2 Integrated Marketing Comunication B2B and B2C

From a marketer's perspective, it may seem that marketing communication strategies in business-to-business (B2B) and business-to-consumer (B2C) industries are fundamentally based on price promotions, however, there are several aspects in which both strategies have many points in common and one of the most important factor for both processes is customer orientation [23].

According to authors Rėklaitis and Pielienė [23], companies in the B2B sector focus on the logic and characteristics of the product, while in the B2C market the decision of consumers will be more emotional, that is, there will be no effort to analyze other alternatives or competitors. In marketing products and services to the B2B market, there is little or no personal emotion involved in the purchase decision. The message is very different when it comes to the marketing approach in the B2B and B2C business sectors. The B2C marketing message, especially if it is online, requires immediate action such as: using a coupon, subscribing to a newsletter, buying at a discount, among others. The B2B marketing message is informative: it calls a

consumer (or customer) to discover something [23]. Povolná [24] refers that the advertising messages issued by B2B organizations should be totally creative and more appealing to maintain a good relationship and attract the attention of business managers.

Choosing the right media channel can be crucial on the way to a successful communication strategy. Camilleri [25] emphasizes that B2C companies with limited budgets choose two or even fewer channels in the dissemination of their message, which increases the risk of wasting time and resources on activities that do not lead to the intended goals and objectives. Therefore, the author highlights that organizations with larger budgets have a greater choice of communication channels, can go for an electronic media channel (TV and radio), print advertising (newspapers and magazines), direct offers such as email, personal selling, public relations, and the internet.

On the other hand, budget constraints in the B2C industry can be overcome by choosing the right marketing tools and fostering the creation of relevant messages to attract consumers, unlike companies in the B2B business sectors that tend to use different communication channels [24]. According to Swani et al. [26], the appropriate media channels for B2B companies are television, online communication, and print advertising. Povolná [24] states that part of B2B communication has become online and predicts that this trend will continue to increase.

Many business-to-business (B2B) organizations are turning to digital marketing to increase customer acquisition [27]. In addition to interactive strategies to connect with consumers, digital marketing offers precise segmentation of potential customers [28, 29]. Organizations have realized that digital marketing in the B2B space increases the flow of information and trust between customers [30, 31]. Today through digital media, B2B customers have access to information about various products and services, which traditionally were not readily available to buyers and as such, this information helps B2B customers to make informed decisions. B2B organizations must maintain an online presence where they convey trust, whether through websites or blogs in online business communities or through social media platforms [32].

Brands drive business performance by influencing the market's perception of a company's products and services, thus making consumers pay a premium for the perceived value [33, 34]. Very recently, some studies have explored the interaction between customers and stakeholders and its effects on the performance of a company in the B2B sector [35]. Organizations make use of social networking sites as Facebook, Twitter, LinkedIn, and blogs, to acquire new customers, maintain long-term relationships with consumers, and increase brand recognition [36–38].

Industrial buyers use social media for their purchase as they compare products, research the market, and build relationships with salesperson [39].

Due to digitalization customers are becoming more informed and rely less on traditional selling initiatives [40]. Buyers are relying more on digital resources and their buying process more often involves the use of social media. For example, in the research B2B buyer survey, 82% of buyers stated that social media content has a significant impact on the purchase decision [40]. As a result, these changes in

consumer behavior place high pressure on B2B salespeople and traditional sales companies [40].

Additionally, 50% of the companies stated that social media has improved their marketing optimization and customer experience, while 25% stated that their revenue went up [41]. Even though B2B companies are benefitting from social media used by marketers, it is argued that research on that area is still in the embryonic stage and future research is needed [42–45]. There is a limited understanding of how B2B companies need to change to embrace recent technological innovations and how it can lead to business and societal transformation [46–48].

Furthermore, the author confirms through previous studies, that the content available on social networking sites is crucial for building advertising strategies. According to the authors [27], researchers have found that effective social media strategies require content that is valuable, engaging, relevant, and timely in which, should focus on helping rather than selling.

Regading price, Rėklaitis and Pielienė [23] compared to the B2C end-consumer market, the sales process in the B2B market takes longer. The price factor is obviously important in a B2B sales strategy, but its importance is limited to the buyer's budget. decision making in B2B markets can sometimes become a very formal process as it can involve several people [26]. Therefore, any organization that focuses on customer service should focus on after-sales activities such as customer loyalty and clarifying doubts about the characteristics of products while, in a organization that operates in the B2B market, it would be wise to provide consultancy services as well as discussions on technical, technological, legal, budgetary issues even without the certainty that the sale will be consumed [23].

In general, it can be concluded that the success of the business will be proportional to the degree of trust between the seller and the buyer since customer service is a highly important element in a marketing communication strategy regardless of the market in which the company operates.

Table 1 presents the types of channels and their preferred tools to communicate in which channel.

3   Child-Oriented Marketing and the New Media Channels

Nowadays, children have many options when it comes to digital entertainment. YouTube has emerged as an alternative to traditional television content as it offers new possibilities for brands to promote a degree of interaction with children and their parents [49, 50]. Young people who use social media are true audience creators and can easily promote electronic word-of-mouth (eWOM) in which they increase the visibility and notoriety of any brand and possibly gradually increase its sales [51]. By identifying the impact of eWOM on consumer decisions and attitudes, brands started by approaching social media influencers (users with a high degree of influence on social media channels and with a large audience of followers) and encouraging

Table 1 Types and communication channel's. Source

Channels	Communication channels	Author(s)
Business-to-Business	• Television • Online Communication • Print Advertising	Swani et al. [26]
	• Digital Marketing • Social Media	Pandey et al. [27], Michaelidou et al. [36], Pandey and Singh [38]
Business-to-Consumer	• Electronic Media Channel (Television, Radio) • Print Adverting (newspapers and magazines) • Email • Personal Selling • Public Relations • Internet	Camilleri [25]

them to create and distribute relevant content related to the brand, a practice called influencer marketing [52].

In the last decade, the advertising and marketing landscape aimed at children has changed dramatically. For example, children find advertising messages from vloggers on YouTube, read sponsored articles on websites, play advergames on tablets, see targeted ads on Facebook, etc. [53]. Thus, children are no longer only exposed to advertising messages on television and print media (such as commercials or brand positioning), but also with online advertising (such as advergames, social media advertising, or banners) and are approached by advertisers on their mobile devices [54].

As mentioned by Schouten et al. [55], celebrity endorsements are a popular way for marketers to promote their brands, products, and services. Many academic studies have confirmed that celebrity endorsement significantly increases the effectiveness of advertising [56]. However, in addition to using 'traditional' celebrities like actors, supermodels, and athletes to add value to their brand, companies are increasingly turning to social media influencers (also called 'microcelebrities') such as vloggers and 'Instafamous' personalities, to endorse their brands [57]. In contrast to traditional celebrities who gained public recognition because of their professional talent, social media influencers (hereinafter referred to as 'influencers'), gained fame by successfully identifying themselves as experts on social media platforms [58]. By enthusiastically sharing self-generated content on topics such as beauty, fitness, food and fashion, these social media users (mostly women) have gained a large following, turning their online social presence into a core profession such as a 'fashionblogger' or 'fitgirl' [59].

Influencers attract millions of followers by sharing curated content from their daily lives on platforms like Instagram and YouTube, evolving around a specific interest domain [60]. While "traditional" celebrities also found their way onto social media, influencers built their careers online and were unknown to the general public before. Not only do influencers have the power to directly influence the purchasing

decisions of a large audience, but their followers also deem them to be credible sources of information [52, 61].

A growing body of academic research is investigating the merits of influencer marketing and the processes that play a role in influencers' effects on brand responses. For example, Lee and Watkins [62] showed that vloggers positively affect consumer purchase intentions for (luxury) brands promoted in their vlogs. Similarly, as showed by Chapple and Cownie [60], consumers claimed to regularly follow lifestyle vloggers' product recommendations, whether buying a product or recommending it to others. In another study, Colliander and Dahlén [63] found that a blog post about a fashion brand resulted in higher brand attitude and increased purchase intent compared to an online magazine article on the same topic, because readers felt closer to the blogger. According to authors Djafarova and Rushworth [61], interviews with Instagram users suggest that influencers are perceived as more trustworthy and relatable than traditional female celebrities, and their product reviews have a significant impact on the purchasing behavior of young women. In a previous study comparing the effectiveness of celebrity recommendations with product reviews from an unknown "average" customer, female participants were more positive about a promoted experience product when it was promoted by a relatable consumer [64].

Previous studies on influencer marketing, conducted among students and adult participants, have shown that influencers are considered more credible and trustworthy than traditional celebrities and are found more likable when they have a high following, as they are then perceived as more popular [61, 52, 53].

4 Conclusion

The objective of this work was to explore the relevant literature on integrated marketing communications and communication in digital environments, including child-oriented marketing communications.

In that sense, we contribute to the innovation literature by showing that in the current digitalization age, marketing communications are constantly changing due to the development of technology. As a result, marketers need to continually test different communication channels to achieve an effective communication. By doing so, we expand the established by Keller [1] and Patti et al. [11], identifying clear benefits of integrated marketing communications. Consequently, this study is line with the literature (e.g.: Rèklaitis and Pilelienè [23]), supporting that B2B and B2C industries should focus on developing a customer's service strategy to develop a degree of trust between the seller and the buyer. Furthermore, this work also contribute to the IMC literature by providing clear evidence of the positive impact that celebrity endorsement has on brands. This result is line with the recent work of Schouten et al. [55], making it even more clear that the celebrity endorsement is a popular way for marketers to promote their brands, products, and services. Relevant insights on the social media influencers are also provided.

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From Design History to Its Transdisciplinarity

Multisensory Fruition Between Cultural Heritage and Digital Transformation

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Abstract The current context is characterised by the speed of change in the technological sphere and in particular by the interconnection—to the point of overlaying—between physical and digital space. This stimulates consideration on the opportunities to explore the new frontiers of knowledge through advanced technologies and unprecedented cognitive-sensory perceptions, both from the user's viewpoint and from that of the researcher. The chapter provides a critical-analytical reflection on accessibility and multisensory issues as fundamental tools for transferring multilevel knowledge between physical and digital. Based on this study, it proposes the configuration of immersive knowledge-sharing environments where cultural heritage and scientific research intersect, placing the user at the centre of experience. The augmented, multilevel fruition, the tracking within the multisensory environment of

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psycho-physiological and behavioural users' data, together with the assessment of experience itself, have guided the design experimentations undertaken for the new layout of the Museum of Contemporary Mediterranean Ceramics in Cava de' Tirreni. This was conceived as a multisensory and accessible phygital laboratory of inclusion and dialogue, a dynamic and adaptive space for sharing and experiencing knowledge.

1   Introduction

At a time when the digital dimension transforms the ways of interaction between user-space-object, it is necessary for cultural fruition to intertwine with research in order to amplify experience. The convergence and interaction between the physical-analogical world and the digital one are shaping a new fluid, "phygital" [52] space, where the narrative ways and the forms of accessibility and experience of knowledge are changing [39].

The contribution proposes a theoretical-practical approach based on accessibility and multisensoriality to share the multidimensional knowledge between physical and digital.

Starting from accessibility in its various forms (physical, cognitive, sensory), standards and directives regarding the configuration of inclusive spaces for knowledge transfer have been identified, analysing the advanced tools and technologies that trigger the user-space-object relationship and simultaneously track actions and interactions, behaviour and emotions generated by the experience of fruition. This required the identification of innovative communication strategies that go beyond the physical dimension. Particular attention was given to storytelling as a privileged tool to transfer visible and invisible knowledge through multilinear contemporary narrative forms. The intention is to overcome any barrier in exploring knowledge to engage an extended range of users through new sensory itineraries, where adaptive interaction gains an essential role.

The critical reading and the interpretation of such factors, together with the design experiences undertaken for the new layout of the Museum of Contemporary Mediterranean Ceramics in Cava de' Tirreni, have enabled the definition of new models of advanced fruition [15]. Furthermore, a multisensory environment-laboratory was configured as an adaptive space for knowledge sharing, where the *user* is placed at the centre of the immersive experience in constant dialogue with the *researcher*, who aims to assess and optimize such experience.

2 Towards Inclusive Approaches: Principles, Directives and Standards

We witness a true "revolution in accessibility" as a result of the many advances and development of strategies, techniques, and solutions specifically designed to be accessible to all [49].

Despite the amount of research found in literature showing the strong connection between the enjoyment, use, accessibility and inclusion of cultural heritage, today there are still several limitations in applying these concepts [15].

In fact, fundamental importance is given to the extensive and complex regulatory system that approaches accessibility in its various forms—physical, cognitive, sensory—representing an effective tool for knowledge sharing and for the transfer of tangible and intangible innovations to the market.

From the analysis of the European and International regulatory framework of interest, it is possible to "enhance" the factors related to accessibility through the definition of requirements and specifications for the design of products and services "for all", with particular focus on the implementation of technologies in the context of knowledge dissemination.

In the international context, the ISO Organization supports the definition of new standards towards implementation in the use of products and services to an increasingly diverse range of people. In this direction, the ISO/IEC Guide 71:2014 [32] defines the main requirements and recommendations related to accessibility, starting from the summary of the terminology in use for this topic, from the necessary objectives for the identification of user needs and from the human skills and characteristics to "address" these needs. Such aspects can be directly applied to the configuration of new experiences of enjoyment and use.

ISO/TR 22411:2021 [33] is more recently established and it provides ergonomic data regarding the effects of aging and the consequences of various types of sensory, physical, and cognitive disabilities. These data can be used by standard developers in applying ISO/IEC Guide 71:2014 [32] to understand user diversity and thus support the development of accessible products, services, environments, and structures.

European standardization is advancing in a strategic way to harmonize national legislation of EU member States concerning accessibility.

Several studies have been started within CEN, CENELEC and ETSI,[1] leading to the publication of a series of mandates on the subject in question. These provide for the expansion of the fields of study and research starting from the paradigm shift towards inclusive and shared approaches.

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[1] CEN: European Committee for Standardization, CENELEC: European Committee for Electrotechnical Standardization and ETSI: European Telecommunications Standards Institute.

Specifically, it refers to Mandate M/473 "Design for All" issued by the European Commission in 2010 to address accessibility through the "Design for All" approach. The aim is to develop specific accessibility "standardization initiatives" extending the range of users by identifying their needs, characteristics, abilities and preferences and their direct or indirect involvement in procedures and processes [54]. This reference highlights the need to consider the different user characteristics from the beginning of the process when designing new multisensory fruition paths for knowledge sharing [15].

In the framework of European Union actions, the same "Design for All" approach leads to the definition of new accessibility requirements with reference to the communication, perception and understanding characteristics of goods and services within Directive 2019/882/EU [24]. In the same direction, the European Commission's "Strategy for the Rights of Persons with Disabilities 2021–2030" considers the need to establish standards to «assist implementation in the physical environment and ICT and to enable organizations to adopt a "design for all" approach» [22].

In line with the goals of the United Nations 2030 Agenda for Sustainable Development [75] and, before that, with the United Nations Convention on the Rights of Persons with Disabilities [74], the new Strategy pays particular attention to progress in ensuring the same rights also to impaired people regardless of gender, race, religion, etc. Different difficulties, including physical, mental, intellectual or sensory impairments need to be considered.

In this context, AccessibleEU [23] will be established, an EU initiative mainly aiming to implement coherence in accessibility policies by facilitating "access to knowledge". National authorities—responsible for implementing and enforcing accessibility standards—will be connected with experts and practitioners from the "knowledge sector".

Developments in the European regulatory framework bring to a new frontier of "Design for All", as defined by the UNI EN 17161: 2019 [73]. As a result of the request of the European Commission to CEN, CENELEC and ETSI (M/473), the document fosters accessibility applied to products and services by also considering interaction with assistive technologies. Moreover, it provides the requirements to plan and manage processes and to understand users' needs and expectations for ensuring greater inclusion.

This standard is complementary to the existing user-centred design methodologies and it describes activities that ought to be performed as an "extension" of the accessibility approach. These activities—divided into (I) identification of users and context of use; (II) analysis and description of users' needs, functionalities and characteristics; (III) definition of solutions according to users' requirements; (IV) evaluation of solutions designed for the widest range of users—define the general framework of the design "for all" process. In particular, the involvement of users—from the initial steps and along the entire design chain—is an essential part of the process. As an input for the improvement of future design processes, it also returns the performance evaluations of products and services.

Within UNI EN 17161: 2019 [73], competitive advantage, inclusive public policies, innovation, sustainability and attention to human rights are the main expected results for the design of easily accessible, understandable and usable products and services.

From the identification and analysis of the above-mentioned regulations (see Fig. 1), it emerged the need to keep advancing towards greater regulatory updates. This can be achieved through synergy between the field of cultural heritage, the world of research, and the overall system of standardization concerning accessibility—a key element for achieving the objectives set out in the different action plans at European and international levels.

It is necessary to define tools and norms that lead to the design of new products and inclusive, multisensory spaces that focus on the real needs of the cultural experience final users [18]. This is possible through a multidisciplinary and intersectoral approach.
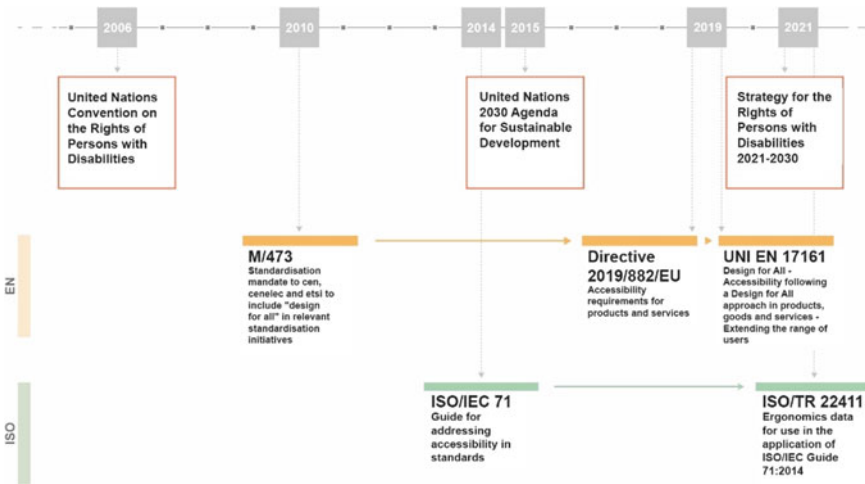

Fig. 1 Schematization of the main "design for all" regulatory references

3   Advanced Tools and Technologies to Amplify the User Experience

To enable accessibility and inclusion of an extended range of users during fruition experiences, several advanced tools and technologies have been identified. These can multiply the levels of information and transfer knowledge through multiple sensory channels.

People interact with the surrounding reality through senses, with which they are able to receive inputs from the surrounding environment and produce them in turn in order to engage users in the interaction experience. In this regard, the technological devices used act as a filter between the external environment and the receptor organs of the human body, to provide the user with a set of inputs as realistic as possible compared to the stimuli coming from the physical environment.

The popularity of Virtual Reality [1] has grown exponentially only in the last decade, with the marketing of high performance and affordable products, such as headsets [30]. These had significant impact on the daily use of audiovisual content in all social areas, from entertainment to industrial processes. The key word around which VR devices gravitate is "immersiveness": the virtual experience must be engaging to the point of making indistinguishable for the user what is real from what is virtual. The degree of immersiveness of a VR application is closely related to how many senses are involved in the virtual interaction.

It is necessary to involve the user's senses mostly affected by the reproduced interaction, with the highest level of realism possible.

The virtual experience in its current significance involves the use of headsets and hand-held controllers. Concerning interaction, this instrumentation acts both as inputs and as outputs: the inputs for interaction are made up of real-time tracking of the movements of the user's head and hands. The output data are instead provided by the headset, equipped with screens and headphones for the reproduction of audiovisual content. The controllers are visible in the virtual scenario through 3D models, which the individual can use to visualize the movements of his hands and interact with virtual objects. This kind of interaction is limiting for the immersiveness of the virtual application since the user can grab objects and move them in the scenario but does not receive any kind of tactile feedback from the contacts. Haptic devices for VR compensate for this deficiency. The most sophisticated haptic gloves allow replicating the texture and weight of the grasped objects, through magnetic or pneumatic actuation systems; cheaper and simpler haptic solutions are characterized by vibrotactile actuators that simulate contact with virtual objects through vibrations imprinted on the affected parts of the hand [57].

The most recent VR headsets aim to increased performance and wearability. The Varjo VR-3 [77] is capable of processing virtual environments at very high resolution. It is equipped with eye tracking sensors, which allow putting the focus of the virtual scene on what the user's gaze is focused on, excluding from high quality rendering the rest of the scenario. This saves computational power, boosting the device's performance; it also features built-in Ultraleap technology for accurate tracking of the user's

hands. Other cutting-edge VR headsets are designed to improve wearability and user comfort, such as the HTC Flow: a virtual reality headset optimized for entertainment and wellness, with a compact and lightweight design.

The immersiveness of the VR audiovisual experience can be enhanced by the creation of photorealistic virtual scenarios, in which the textures of each model are generated from photographic captures of the real objects [60]. 3D reconstruction techniques, such as photogrammetry or laser scanning, allow to derive data related to the geometry and aesthetic characteristics of real objects with high accuracy and with a very good realistic rendering.

Beyond the more common use of VR, a growing number of cutting-edge devices populate research and prototyping fields with innovative solutions for producing multisensory stimulations. Some prototypes have been developed in recent years for the involvement of the user's taste and sense of smell during VR experiences. This is the case of the Feelreal device: a multisensory mask to be integrated with the VR headset, capable of reproducing hundreds of smells by mixing the nine refillable cartridges with which it is equipped. In VR, smells are associated with what the user comes into contact with; the mask is able to generate airflows on the user's face, for a more dynamic exploration of environments and to improve comfort of the experience [79]. From the studies of Narumi, "Metacookie" was prototyped, an Augmented Reality system for manipulating taste and satiety sensation that does not alter the chemical composition of what is ingested. The system involves printing a marker on a cookie, this marker allows the AR instrumentation to associate an overlaid image with the cookie to alter its appearance in the AR scenario; by chewing the cookie, the user has the illusion that it tastes as recreated by the instrumentation [50].

An interesting study conducted by [65] proposes a reconnaissance of multisensory devices (haptic, olfactory, gustatory) as well as a real manual to build multisensory systems, called "mulsemedia environments".

In addition to the involvement of the user's senses, a significant increase in the realism of the virtual scenario is brought by tracking body movements. The perception of own position in space is crucial for the awareness and safety of the movements performed within the digital dimension. Commercially accessible solutions for accurate tracking of user movements are available, i.e. Leap Motion [72], a device for tracking hand movements in VR at a maximum distance of about 80 cm from the optical sensor. The integration of Leap Motion allows users to interact with the VR scenario through their usual gestures. Awareness of the user's position in space can be enhanced by the presence of a 3D avatar, which replicates the actual movements of the user's body. The avatar can reproduce the user's movements in real time with high accuracy, placing a limited number of small footprint tracking devices (e.g., HTC Vive Tracker) and reconstructing the movements by combining direct and inverse kinematics.

The advanced technologies analysed allow the configuration of immersive multisensory experiences aiming to transfer multilevel knowledge through the interactive engagement of users.

4   Communicating Knowledge in Cultural Environments

The requirements of accessibility, in its various forms, and the advanced technologies, prove to be fundamental for sharing multilevel knowledge from the visible to the invisible. It is therefore useful to find appropriate forms for communicating knowledge through analogue and digital media to meet the needs of the extended range of users. Traditionally, information that guides the paths of fruition used to be provided through textual data, such as labels and descriptions, possibly enriched by photographs or explanatory reconstructions. Nowadays, to foster user engagement, the visualization of information takes place in different ways, such as through infortainment, gamification, virtual and mixed reality [36].

According to [53], "affordance" [27] and the "implicit communication" [13] are useful tools to support the individual while using an artefact. In fact, to communicate knowledge, a design that makes content accessible and ensures usability during interaction with objects and in the use of spaces, cannot be ignored. Therefore, in order to propose performance spaces that can actively involve the user, the exhibition project must explore the relationship between space, technologies and narrative structures [71] from the earliest design phases, through contemporary communicative languages.

Communicating knowledge thus means designing and organizing relationships with objects that allow users to understand the interpretative grid needed to decode information [3].

Studies related to human–computer interaction have advanced significantly aiming to bring the places intended for knowledge sharing closer to end users, through innovative paradigms of interaction design and configuration of customized solutions [59].

Designing interaction by improving access to contents and enhancing usability allows to fully exploit information capacities, make better use of interfaces and, finally, deliver content to users with the support of devices that explore virtual environments by optimizing the relationship between "real space" and "virtual space". Aiming to create new ways of knowledge and communication for the definition of personalized paths of fruition [59], some museums have placed increasing attention towards the definition of multisensory experiences. In fact, the relationship between users and digital devices can be established through multiple communication channels such as voice commands, gestures, virtual and augmented reality, neural and human–machine interfaces.

It is therefore possible to consider virtual reality as an "experiential" interface, in which the perceptual component merges with interactivity [64]. However, as a means of communication, Augmented Reality (AR) is not yet a widespread technology, but it offers numerous potentialities to enrich the experience of knowledge, which becomes dynamic and multisensory. It also proves its capacity in disseminating information, since the user is stimulated by his surroundings. In such reality, the experience becomes multisensory, while natural-real and virtual-digital elements coexist in the same space [81].
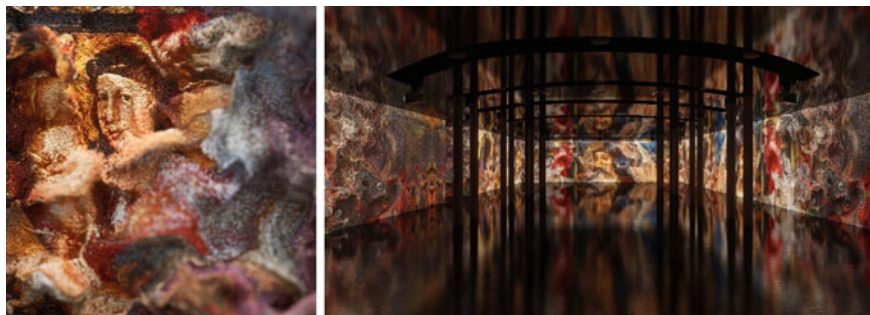
Fig. 2 Renaissance dreams installation by Refik Anadol at the MEET in Milan

According to Riva and Gaggioli [64], in the contemporary scenario, the progressive integration of digital devices for the democratization of knowledge configures "interreality" environments as hybrid physical-digital ecosystems characterized by the continuous and bidirectional exchange of information and data between real and virtual worlds.

The supports generated by digital tools can create awareness and facilitate intellectual and sensory understanding. According to MiBAC's "Piano Triennale per la Digitalizzazione e l'Innovazione dei Musei" [20], such aspects represent the enabling prerequisite for in-depth knowledge. In this context, interoperability between devices and heritage increases the level of understanding and satisfaction of visitors. Fostering physical interaction with digital tools for the use and knowledge of cultural heritage in order to access contextual audio and video contents that provide insights, is among the identified strategies.

An example of physical fruition of digitized heritage is the site-specific "Renaissance Dreams" [45] installation by Refik Anadol at the MEET international centre for digital culture in Milan, inspired by the Italian Renaissance. The project addresses topics related to painting, sculpture, literature and architecture, collecting around one million images and open-source texts of works of art and architecture produced between 1300 and 1600 (see Fig. 2). Data was processed by an artificial intelligence using GAN[2] algorithms, capable of identifying common features in the images and texts and, from these, producing creations with dynamic multidimensional forms. Thus, the installation becomes a sensory immersion in the history of the Italian Renaissance.

Alternatively, the Lieu.city [37] platform can be considered an example of digital fruition, allowing to visit exhibition spaces in virtual reality, defining a new experiential, interactive and fruitive way of using places, where knowledge transfer plays a fundamental role (see Fig. 3). In fact, in any location, users can interact with the exhibition environment and with participants and event organizers in real time, using VR headsets. This project uses innovative methods that allow and guarantee the user access to places, experiences and information.

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[2] Generative Adversarial Network.

Fig. 3 Leonardo da Vinci exhibition on Lieu.city

The use of digital technology allows users to enjoy innovative and engaging experiences, as in the case of the HoloMuseum at Castel del Monte [47], where the phygital mode becomes an opportunity to define new forms of using and sharing knowledge. The path is integrated with Microsoft Cloud Computing, Artificial Intelligence and Mixed Reality technologies that enhance and amplify the narrative and expositive capacity of the exhibition. Thus, they offer the possibility of integrating additional information and experiential levels compared to those provided by the physical layout (see Fig. 4).

Fig. 4 Museum tour of Castel del Monte

The widespread use of innovative tools applied to knowledge sharing processes configures the user experience as a complex combination of new contents and interactive modes of communication. Multisensory and "amplified" knowledge experiences can involve users by overlapping real, virtual and multimedia environments. In this scenario, the user superimposes elements and information to the reality with which he interacts, moving from a static to a dynamic fruition. Dialogue and knowledge sharing are encouraged through hybrid languages and customization of the user experience in an emotional and multisensory path [28].

5 Multilevel Narratives to Transfer Visible and Invisible Information

The separation between engaging, technology-mediated experiences and the actual transfer of scientific and cultural knowledge to the public, places more attention on the role of narrative as a tool capable of transforming complex processes and themes into accessible products for users.

The plurality of the available communicative forms allows to amplify the levels of the narrative [71], adapting them to visitors [15], in new models of fruition that rewrite the user-space-object relationship.

The different narrative forms identified for the definition of multisensory and inclusive cultural models [15] pave the way for the design of multidimensional narratives as tools that enhance physical-digital connections with a strong emotional and cognitive component on the one hand, and a technological one on the other [7].

Contemporary multilinear narrative forms foster user interaction with objects and virtual environments by enhancing a participatory approach through the senses. This activates new semantic and narrative levels within spaces where the multisensory experience adapts to pre-existing itineraries.

To recreate physical and digital connections functional for knowledge transfer within immersive spaces, narrative modes can be inserted to activate cognitive processes, in a dimension that is also physical and that stimulates imagination through signs and clues. These elements make significant every gesture and every movement, in a process of layering actions and events that coagulate into microstories, narrative cores, which are deposited in the memory stimulating users' imagination [5].

Moving beyond induced behaviour, multidimensional storytelling introduces unexpected outcomes for the user, in a learning process closely linked to the space and time of the experience:

- The space where the user interacts with the physical dimension by following a temporal narrative path marked by the provision of narrative clues as activators of connections with the digital dimension;
- Time of the actions, guided by different interactive and sensory modes—and adaptive with respect to the user—through which the visitor can unlock various narrative levels.

The narratives are activated by gestures and actions that the user performs, letting himself be guided by experience to sensory explore the space and be surprised by what his actions entail [5]. These aspects lead the user to the construction of a personal "spatial discourse", a flow that represents a new and personal narrative reading key to the experience.

In this case, technology becomes an integral part of the exhibition, it is "invisible" and it uses the person's gestures to activate contents, pointing attention to details and hidden aspects. In a hyper-mediated dimension [6] instead, the individual recognizes the space of "narrative production" and uses technological tools to decode and interpret it by crossing a perceptual and cultural threshold [71].

[71] identifies three main orientations to "augment" the narrative [43]:

- Exhibit devices between tangible and intangible dimensions where interfaces and spatial and material qualities make the exhibit increasingly involving;
- Engaging spaces where the narrative infrastructure is the core element for a multilevel fruition;
- New behavioural landscapes of users in performative spaces.

By combining the three orientations, it is possible to configure a multilevel narrative space, where knowledge is made accessible in a layered way and conveyed through narrative devices that stimulate all senses, in an immersive spatial dimension for users.

In this direction, the "10D Experience" realized in Casa Batlló [12] proposes a "journey" inside Gaudí's mind through the use of advanced technologies (artificial intelligence, augmented reality, immersive technologies) in multisensory rooms that allow the user to explore new perceptual thresholds through sight, touch, hearing and smell. Starting with the five senses, the narrative project immerses visitors in Gaudí's mind aiming to perceive reality through "the eyes" of the Catalan architect, through the projection and perception of elements that inspired his works [58]. Gaudí's digital archive (files, photos, videos, drawings, 3D models and original manuscripts) is transformed into a narrative experience accessible to the public that highlights otherwise invisible details and features.

Narrative represents a "threshold" experience between real space and digital dimension [48], mediated through physical experience—in a process of embodiment—and a conduit to access reality represented in the digital. Within immersive three-dimensional environments, "threshold objects" [48] become facilitators in the transition from the real world to the imaginary one. These are physical devices that appear both in the digital dimension and in the real world, facilitating the user's immersion in the story and his/her active participation at different levels of interaction.

The story can immerse the user through narrative devices increasingly related to perceptual-sensory exploration or it can be mediated through characters with a high level of realistic rendering through the use of holograms or avatars [70]. Such tools lead to hyper-realistic experiences with the overlapping of the real and virtual worlds, allowing for these types of narrative approaches in ongoing storytelling.

Narrative activates inclusive processes of knowledge transfer. If configured in an adaptive way with respect to the different visitor profiles, through declinations, techniques, languages and storytelling methods intended for all target users [15], it is capable of simultaneously involving heterogeneous audiences.

Within the phygital space, several narrative layers—temporal, spatial, thematic, etc.—can be integrated to activate multidirectional paths. The design of multiple narrative registers in the exhibit space allows therefore the diversification of experiences, which become adaptive depending on the choices made by users.

Storytelling is thus transformed into a participatory tool for the user, especially if through his actions he can activate new levels of narrative, take part, or change the outcome. This type of participation provides the interlocutor with the pleasure of actively engaging to play a role in the narrative and transform its outcome [17]. The user becomes an actor in the progression of knowledge creation in participatory and cognitive-emotional processes [67] and the "living" space within which new stories come to life.

The integration of multilevel narrative forms within advanced technological systems allows to explore and deepen the expressive and cognitive potentialities in the human–machine relationship [5]. Storytelling becomes the medium to track users' experiences through stories able to emotionally engage them, in a research space that explores new narrative dimensions.

6 Accessibility and Knowledge Sharing Between Physical and Digital Space

In the current scenario, knowledge sharing assumes complex forms. Cognition is shaped through the filter of advanced technological tools, communicative ways and narrative forms, offering the possibility of returning sometimes inaccessible information to users. Despite the potential of digitisation to enhance access to information by all, there are still many limitations in bringing such experiences to life and involving users in the process of advanced fruition. At times, advances in technology and digital interaction perpetuate existing inequalities instead of reducing them [46, 51].

The relationship between real and digital becomes increasingly complex. The two dimensions, apparently far from one another, are today caught in a continuous dialogue, a process of contamination and redefinition.

The connection between cultural artefacts and users emerges through a new perspective that can be mainly expressed through engineering and design disciplines, tending to introduce the correction of a humanizing image [26]. Thus, design is increasingly involved in the representation of a digitized image interested in the programmability of the functioning and animation of intelligent and interactive IT objects and equipment, in the sense defined by Frateili as "pansensory".

The real frontier of integration between the real and virtual dimensions probably lies in breaking down barriers with physical reality and with the ambition to recover

the sensory and bodily dimensions. One could envisage a physical world augmented by shared multimodal information where the concept of "metaverse" described in Neal Stephenson's 1992 cyberpunk novel "Snow Crash" as an overlap between the real world and the imaginary takes on a different connotation [9]. It can open us up to the participatory horizons of augmented reality rather than isolating us from the physical world. The metaverse will provide a presence in the physical world interactively augmented by digitally shared multimodal information rather than a virtual immersion [11]. Digital tools have a potential role in increasing access to large amounts of information, with the possibility to adapt to different styles, interests and needs [68]. In fact, they are perceived as tools able to multiply the perspectives of the user experience, increasing its attractiveness [38] and providing various levels of interpretation. An interactive and engaging experience is to be achieved, that can contribute to learning and increase attention [25, 29, 55, 61, 78].

It is necessary to understand how to transfer multilevel knowledge beyond the surface, providing the public with the opportunity to reach hidden layers and, at the same time, satisfy users' interests while searching for new forms for sharing. Knowledge of artefacts can in fact become multisensory by amplifying the tactile, olfactory, acoustic, spatial, and visual dimensions. They are not experienced from an established perspective, but by moving in and around them, assembling and disassembling them, using them as interfaces to explore the world [66].

Such conditions lead to an increasing trend towards the use of specific models able to rebuild the space and to provide useful information to the user during the tour. An interesting example is the case of Van Abbemuseum, which has applied a model of advanced fruition in collaboration with the blind designer Simon Dogger to support navigation within a space. The aim is to enhance the fruition experience for people with visual impairments and for all users during the museum tour. The new system recognizes the registered space, and it offers information under various forms, visual, sound, tactile vibrations, fostering inclusion. The users-visitors are therefore encouraged to discover the space, to interact with artworks and to access visible and invisible information during the entire fruition itinerary [21, 76].

Man becomes the fulcrum around which the process of accessibility between real and digital revolves, in order to design experience and guide the behavioural dimensions through values, forms of digital representation and interpretation, and strategies of signification. Thus, complexity and diversity of the human condition are extended to every sphere of experience and knowledge [10].

Essential questions arise in designing physical, cognitive, and sensory accessibility. They concern the individuals' mode of use, their ability to interact, resolving interface relationships on a pragmatic and psycho-perceptive level to "facilitate" the user-artefact dialogue through an attractive effect, a stimulating appearance and greater humanization [26].

Within the environment, visitors must perceive the overall situation in which they find themselves acting, using conceptual models specific to their culture. It is through action that cultural models will also be revised and modified, making use of information dynamically provided by the context.

Aiming to explore the "repositories of knowledge", the case of the Depot Boijmans Van Beuningen in Rotterdam, "the first publicly accessible art repository", is noteworthy. The architecture was designed *ad-hoc* as an "engine room" that reveals the world behind storage and preservation of a high number of works of art and drawings of considerable interest, which had not been previously exhibited in museums. These artworks become accessible to the public being displayed to enable their observation from all angles [31]. Opening up repositories and archives solicits innovative collaborative models to enhance users' accessibility, encouraging a hands-on approach to knowledge and supporting open models that equate preservation with the proliferation of information [10].

The context of action, therefore, is seen as a "scenario" that captures the sequence of actions and interactions, becoming, above all, a context of meanings of possibly shared social and cultural interactions.

Thus, the environment, where one or more users find themselves in, loses its connotation as a stable supplier of information and it becomes a multi-componential scenario where actions take place and information dynamically flows. The action space becomes both physical and conceptual.

7 Tracking Behavioural and Emotional User Experiences to Design Adaptive Itineraries

In designing fruition spaces, understanding emotions still has limitations when considering the real complexity of the human experience [63]. Stimuli coming from the external world are first to be processed by the sensory organs and afterwards by the dedicated parts of the brain to produce significance and emotions [44]. It is the collaborative, continuous and simultaneous activity of very different sensory areas that provides significance to information that reaches the brain [8].

Since childhood, people perceive objects and the surrounding environments due to physical characteristics (shape, colour, texture, etc.), as well as through the dynamism, relationships and interactions taking place between them (contact, contrasts, etc.) or between individuals and artefacts. Interaction with artefacts therefore depends on the one hand by information provided by the object itself and, on the other hand, by the designer's capacity to render its functioning clear and intuitive [8]. Currently, besides the five senses, the haptical, synaesthesic and kinaesthetic systems are considered, being able to increase the complexity of the user-object-space interaction.

To understand visitors' emotional experience, an interesting study at St. Gallen Fine Arts Museum investigated how artworks and the way they are placed have an impact on experience and on the user's behaviour. The project provides assessment on physical interaction with real artworks, proving that the user's emotional engagement depends on his/her own characteristics and that the fruition experience has a higher impact on the individual than it had previously been imagined [34].

Interaction with the environment, the itineraries, the artefacts, is therefore influenced by the ways how senses are stimulated, which requires particular attention towards multisensoriality in the design process. It is necessary to intend the fruition spaces where the user-object interaction takes place, as transformative, multisensory spaces able to stimulate emotions. This is possible due to the adaptive use of materials, lights, colours and new technologies, going beyond their common application [80]. Designers turn projects towards sensory multidimensionality, for the products, services, and spaces to be able to reach a higher diversity of users, supporting all of them in receiving information, exploring reality, experiencing emotions beyond the individual sensory capacities [41]. In this direction, DeafSpace is a theory and practice of design for people with hearing impairments that highlights the capacity of sensory elements to contribute to the individual experience. Some principles of sensory design have been put together based on deaf people's instinct of adaptation, since they constantly recreate their own environment in order to increase sensory experience [40].

Nowadays users are interested in searching for multidimensional experiences and for information available through multiple sensory channels, which requires the reconsideration of fruition paths. There is an openness towards experimenting with new forms of mediating experience through different contexts and with different intentions. In the case of "The Blind Spot" exhibition, the perfumes, touch, sound, integrate visual perception through the 4D reconstruction of works of art to encourage augmented sensory experiences [14]. Other examples, such as the installations Tactile Orchestra at the Cooper Hewitt Design Museum [42] and Dream Machine [4], explore the possibility to "visualize", "touch" or assimilate sound to specific perfumes through unprecedented materials and experimentations. Elements which are thus "orchestrated" as part of the scenography to share an experience, explore and reveal new ideas, perceive beyond the surface.

The exploration of emotions has inspired the realization of a new experiential path at The Museum of Feelings, New York [62], a space where users find themselves immersed in an environment that transforms emotions into "live art", codifying them through colours with the support of biometrical technologies. The tour begins from the outside, where the "live" façade is coloured in the "emotional state of the city", based on a real-time algorithm that extracts data on the context and on the community's prevailing feelings. Within the environment, the user is guided through various spaces that stimulate emotions and generate interactions by tracking and reacting to users' movements and gestures through sound and light effects [62].

The new forms of exhibition between the physical and digital dimensions represent places that promote learning through mutual exchange, through discovery mediated by new sensory perceptions, rather than spaces that transfer a constant or complete amount of knowledge. The space of enjoyment, use and experimentation is no longer simply a means to represent the "known", it rather becomes an opportunity to learn new aspects about the "unknown", opening up new perspectives through multisensoriality.

The olfactory sense, for example, has a direct cognitive connection with areas of the brain involved in managing emotions and memory (differently from the sight

and other senses). Therefore, it has the potential to become a real design tool within fruition paths that stimulate users into hardly "forgettable" experiences. This is the case of the "In Love with the world" exhibition at the Tate Modern Museum [69], where *arts* and *science* meet, creating an olfactory scenery where advanced technologies play a fundamental role. Lightweight biomorphic robots move through air to simulate live beings. Also, through specific sensors, they identify users' body temperature to understand the right moment when to get close to the person, as "intrigued" by human life. The aim is to engage users in an experience that re-imagines artificial intelligence and it encourages reflection on the impact of the olfactory scenery on the physical, cognitive and emotional state, through the complex human–machine relationship. Human beings and machines can be companions and relatives to one another [2].

The potential of living a performative, scenographic and sensory experience of an exhibition stands therefore in the ability to reveal something new on the relationship with architecture and artefacts, something that stays in the user's memory long after the "time stamp" of the experience itself is gone [80]. The new technologies push us to reconsider emotions and consequently to reshape the design of experiences. The voice humanizes interactions, social robots accompany impaired people, augmented reality invites us to deeply reflect on the quality of sensory information and on the physical experience [56]. All these issues highlight the potential impact that the analysis and understanding of emotions will have on design. At the same time, they prove the need for such aspects not to be disregarded when designing the experience. Thus, proper consideration needs to be provided to the stimulation of human emotions and perceptions within the fruition itineraries.

8   "Multisensory hAll"

The analysis of the communicative approaches, narrative structures, interaction and sensory stimulation technologies, as well as the inclusive and accessible design principles, enabled the configuration of a multisensory phygital environment-laboratory within design experimentations undertaken for the Museum of Contemporary Mediterranean Ceramics in Cava de' Tirreni. This environment is an adaptive knowledge-sharing space defined by an immersive and transformative architecture with a dual function. On the one hand, it aims to make scientific knowledge accessible through narrative experiences and augmented fruition to communicate science and culture. On the other hand, it intends to test and track the experience by collecting behavioural and psycho-physiological data of users immersed in augmented reality spaces and subjected to neuro-audio-visual stimuli. Within the exhibition space, the user regains the main role in the fruition process, in superimposition with the researcher engaged in data acquisition, analysis and assessment for the constant optimization of the experience.

The Multisensory hAll project addresses an extended range of users and it engages people with different physical, functional and cognitive characteristics in an inclusive manner, designing various levels of accessibility that stimulate new sensory dimensions and favour knowledge acquisition from different perspectives.

As defined in the design phase of this study, the characteristics of the layout concerned first of all the user-space interaction, in the physical and digital dimensions, guided by the need to favour adaptive orientation and guarantee accessibility to a wider public. The presence of coordinated elements such as textual indications, images, simplified diagrams, and schemes accompany the user along the itinerary and through the different exhibition scenarios, while information is transferred through multiple sensory channels, following the principles of design "for all". Where information sharing through visual modes is foreseen, these shall be associated with at least one mode of operation that does not require sight [24]. Thus, the user is guided within the environment through visual, sound and tactile information, using analogical and digital tools that activate different sensory channels and provide the possibility to enjoy the route according to one's needs.

The space where the sensory engagement process takes place is enveloping, flexible, adaptable, and it can change its function in relation to users' and researchers' needs, to accommodate multiple exhibitory, experiential and research scenarios, and to open up to the digital dimension of multilevel narratives. It represents a combination between the "white box" and the "black box" [35], a fluid environment between physical and digital space, capable to transfer knowledge through multisensory interaction.

In line with the function of "immersing" the user in the multisensory experience, the layout is configured with a suspended structure that hides the walls and ceiling of the environment, redefining the space in a welcoming and all-encompassing way. The architecture of the exhibition space aims to achieve maximum attention and engagement of the user, who is completely immersed in the sensory experience from the beginning of the itinerary. In fact, the structure "invades" the entrance, thus becoming a representative sign that, with a "shell" shape, welcomes the user into the environment (see Fig. 5). Such configuration is made possible by the presence of rear projection canvases, particularly suitable for setting up immersive and augmented experiences.

The digital experience amplifies the physical space and allows the user, from the very first moments of exploration, to be fully immersed in a hybrid space, that provides different opportunities for sensory interaction. With the support of technological tools, the elements of the physical space activate multilevel narratives in the digital dimension in a continuous process, elaborating and transferring knowledge. Technologies make the complex system of knowledge transfer accessible, conveyed through different communication channels. These amplify users' experience and activate narrative processes starting from gestures, actions, movements in the laboratory environment.

Through a quick set of information, the user is matched to a person-profile that, based on needs and preferences, triggers adaptive suggestions along the way, due to the use of identifying codes. These are capable of orienting, tracking progress

Fig. 5 Multisensory hAll entrance. The "shell" structure returns an all-encompassing space enabling complete immersiveness

in digital experiences, and evaluating experience at the stations of greatest interest and in the ability to transfer information. The system is integrated into the physical space, and it accompanies the user in a sensory exploration as well as in activating contents through various physical elements scattered throughout the environment. Through a sensory map, users can access from their own device the location of the main augmented stations and basic information on the itinerary. All data are made accessible through different modalities—such as visual information, sounds and vibrations—in order to guide the user according to the needs identified in the first phase of system activation. The map is also designed in a physical, embossed format, to allow visual and tactile orientation [15].

Aiming to transfer multilevel knowledge from the visible to the invisible, it is essential to equip the space with useful tools to increase the layers of information activating multisensory perceptions at different levels of detail. Some suggestions will be provided by the person-profile that can be used during the experience to activate and deactivate guided exploratory moments and moments when to act freely in the phygital environment. To stimulate its use, each assigned profile-person can become a character in the digital story, under the form of a hologram or virtual avatar, to guide the user and personalise experience.

To amplify the multisensory experience, the environment includes projectors, "interactive eyes" and "pockets" for the enjoyment and use of the "invisible". A first "immersion" of the user in the physical space takes place through the rear projection of 4D videos that narrate the corresponding context, integrating a 3D sound system to restore the three-dimensional soundscape of reference. Inside the space, sensor-integrated scent diffusers are activated as visitors pass by, stimulating olfactory interaction and sensory perceptions that enhance the memory of the immersive
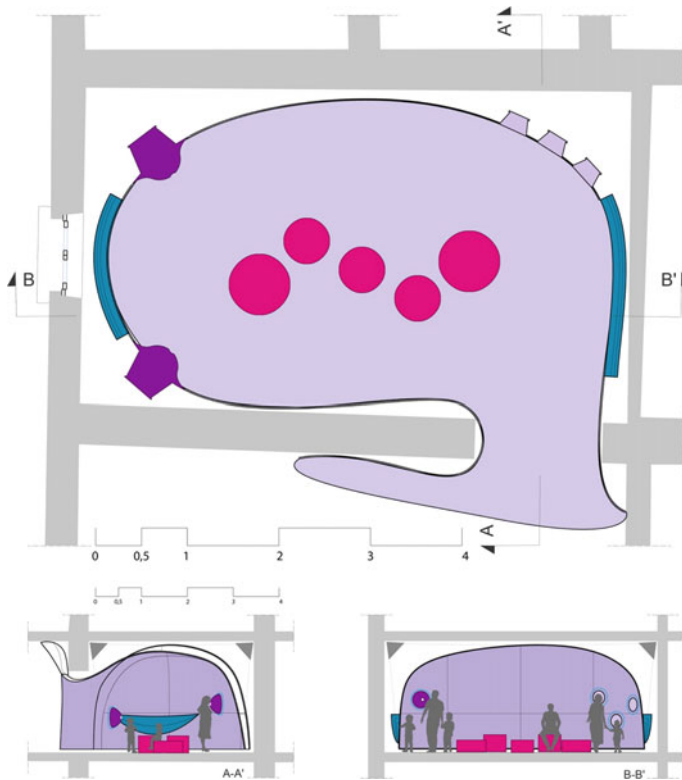
Fig. 6 Space organization with "interactive eyes" and adaptive "pockets" to enable facilitated interaction and respond to the different physical-dimensional-behavioural needs

experience even after the visit. The route consists of several sensory stations (see Fig. 6), arranged as "interactive eyes" on the "walls" of the structure, where users can explore hidden parts and replicated artefacts through the senses. Alongside a predominantly visual and audible interaction of the user who is "immersed" in the cognitive process, there is tactile interaction in haptic stations. This provides the possibility of amplifying the visual experience through augmented reality devices.

A third type of "interactive eyes" combines the different modes of interaction, visual, sound, and tactile, allowing visitors to increase the layers of information through a 4D experience. This makes it possible to experiment advanced technologies—useful for transferring the materiality of objects into the digital dimension, such as the use of haptic gloves that amplify the user's tactile exploration.

"Pockets" placed on the "walls" of the room allow exploration of hidden elements to increase curiosity and awareness of the need to explore through senses other than sight. Both the "interactive eyes" and the "pockets" are set at different heights to allow adaptability to the different physical and dimensional characteristics of users,

in line with the principles of accessibility and inclusion that have guided all phases of the design process.

To amplify the multisensory perception, an interactive vibrating floor is integrated within the installation, reacting to the users' actions and movements. The structure has a dual function, firstly to orientate the individual by means of a ground surface lighting system, and secondly as an activator for synergic and collaborative participation between users. The spaces for individual and collective action are signalled through the activation of light sensors, colours, textures, and vibrations in the flooring. In addition, vibrating floor stimulations allow curators to set up dynamic and close-to-reality augmented and virtual experiences.

Through the experimentation of new design scenarios and augmented experiences, the phygital environment is configured as a laboratory of interactive processes, where the user's experience guides the design of contents, narratives and the tools to seize them. The space becomes both container and engine of the experience through modes of advanced fruition aimed at engaging the user-visitor and the researcher in a participatory process of co-creation and transmission of knowledge (see Fig. 7).

The spatial configuration lends itself to the dual purpose of making scientific knowledge accessible through multisensory narrative experiences (see Fig. 8) and tracking the behavioural and psycho-physiological data of users immersed in phygital experiences. Tracking is made possible by the integrated system used through the identification codes, biometric technologies, Bluetooth proximity sensors, eye-movement tracking, behaviour analysis.

Such technologies make it possible to track the user experience, such as emotions, behaviour and choices made along the way, and thus obtain data useful for assessing and optimising use. The role of individual, environmental and genetic factors on
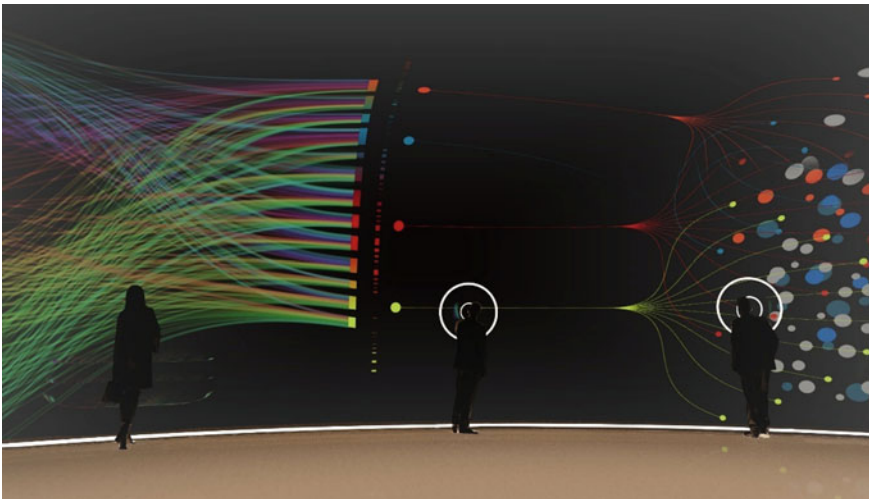

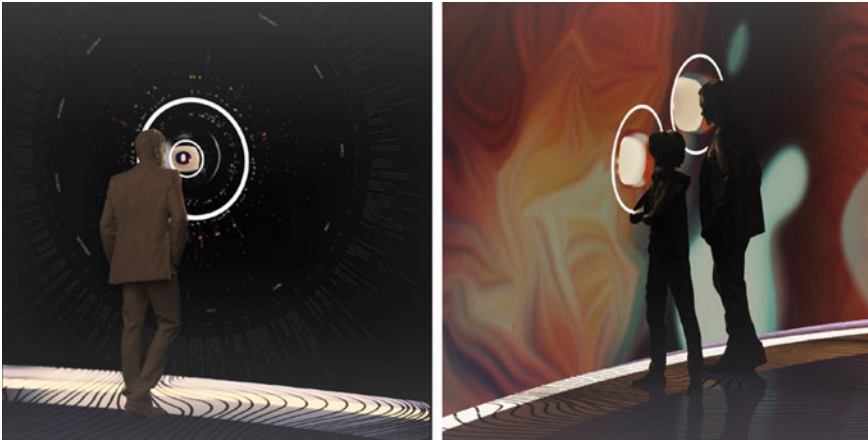**Fig. 7** The immersive space encourages knowledge transfer

Fig. 8 "Interactive eyes" stimulate multisensory narrative experiences

cognitive processes, on perceived environmental and psychological comfort, and on social interactions in real and simulated environments (virtual and augmented reality) is investigated. The results obtained after analysing data will lead to new solutions to be tested in the laboratory environment through unprecedented experiments in which researcher and user-visitor find opportunities for dialogue and interaction.

9   Conclusion

Through a critical-analytical reading of the factors concerning accessibility and the definition of inclusive spaces, the illustrated proposal collects design experiments for the new Museum of Contemporary Mediterranean Ceramics. These have led to the identification of new ways of use and enjoyment, and to the configuration of a multisensory phygital environment, as a place for sharing multilevel knowledge.

The Multisensory hAll aims to transfer knowledge through immersive and multi-sensory experiences, and it is configured as a dynamic, customizable space for new contents and narratives referred to different themes and contexts.

For cultural heritage fruition, the structure can integrate narrative elements and replicated objects that are part of the exhibited collections or of the ones stored in repositories. It can embrace performative moments or replicate digital artists' artworks.

In fact, technologies and the various elements that integrate them lend themselves to different kinds of immersive scenarios, while the exhibition structure adapts in shape and size to the space that houses it. Thus, curators are given the possibility of personalising narratives and content according to the exhibition environment.

Multisensory hAll has been designed to engage a wider audience in an inclusive view, defining various levels of accessibility to stimulate new sensory dimensions and favour knowledge transfer between cultural places and research, where tangible and intangible intersect beyond physical barriers.

The augmented fruition experience—mediated by multilevel narrative forms and by advanced technologies able to activate sensory stimulation in an inclusive view— the tracking of psycho-physiological data and of users' behaviour, and the assessment of user experience become an integral part of the immersive space able to transfer knowledge to different accessibility levels.

The new phygital laboratory for inclusion and dialogue [16] represents a dynamic place where knowledge finds "channels to circulate" [19] and tools to reach different levels of users. An itinerary where each gesture and movement undertake significance by revealing previously unknown cognitive and sensory potential within the user-space-object relationship. The user's role is not anymore limited to the "programmed" interaction, instead it receives unexpected events to which he/she can react in an unexpected manner [5] through a succession of actions trackable by researchers, thus enhancing experience in the new demonstrative scenarios. The narrative layers of the phygital space trigger as many sensory levels in paths capable of stimulating all the senses in an adaptive way, activating cognitive perceptions that engage users and make the space accessible and inclusive.

Its dual function of enjoyment and research is useful on the one hand to understand the real potential of current tools, on the other hand it brings to an enhanced awareness on the fruition process. This serves to configure increasingly engaging experiences for users in a new phygital frame, where knowledge can be generated and transmitted.

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Mapping Ecosystems Through Design—Reflections of the DesignOBS Project

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Abstract This chapter explores the results obtained from the application of a participatory process used to interpret databases about the Design discipline. This project was undertaken within the project: For a Design Observatory in Portugal (DesignOBS). The challenge focused on developing a one-page visualization about at least one database focused on a vector of the design ecosystem (design companies, design research, design education). In total, 41 works from 70 design students from two different schools and 9 works from design professionals, with multiple backgrounds, were collected. After a preliminary selection, the results were displayed in the first exhibition of the DesignOBS project at the Faculty of Fine Arts, University of Lisbon. This chapter presents into the results obtained—it provides a description of the visual projects and reflects on the potential contributions of using design as an approach to support the mapping of ecosystems in Portugal and abroad.

Keywords Design visualization · Information design · Participatory approach · Design education

1 Context

More than ever, data is being produced and released by governments and other organizations to improve transparency, make better governing decisions, raise the quality

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of decision-making by giving citizens and consumers "adequate tools". However, considering the amount of available data, it has apparently minor consequences, as very few players seem to be able to truly capture its value [1].

In the design context, there are already an increasing number of tools, methods and workshops that aim to explore the role of data literacy to develop new products and services [2, 3]; or materialize information that helps the public to navigate societal issues and challenges [4, 5]. Considering design as an activity of cultural mediation [6], we argue that these emerging capabilities could lever the development of better public policies to mature the strategic importance of the discipline, especially when there are no formal infrastructures to keep track of its evolution and status quo [7, 8]. By adopting a more active role in data collection, mapping and interpretation, designers can champion more participatory discussions about Design and, ultimately, enrich ecosystems, taking guided actions based on data.

Recent studies from the DesignOBS project (Towards a Design Observatory in Portugal) aimed to tackle this issue by collecting, curating and sharing datasets about the multiple vectors of the design ecosystem (education, research, designers, users, etc.—[9], and map these indicators via a distributed observation approach with design schools scattered around the country [10–12]. The latest work developed within the project focused on infusing data literacy in design education and creating new visual interpretations about Design [7]. The hands-on activities resulted in infographic posters examining multiple variables of a dataset with numerical and textual information about design companies in Portugal [8] that are available on the project website (www.designobs.pt). The application of this approach transformed the perspective of young designers over their own roles in the data world and supported the design of new mediating materials about the discipline. However, additional studies are necessary to explore if and how the visual materials generated can drive the emergence of new inquiries about design, improve its visibility, and, ultimately, support the development of new public policies/actions for the discipline that enable a more effective infusion and use in the Portuguese socio-economic fabric. Whereas Costa et al. [7]. focused on students' perceptions and limitations in dealing with databases as a design source, already hinting at new inquiries based on data, this chapter focuses on the results obtained when the expansion of this participatory approach includes professional designers. Additionally, it reflects on the visual materials generated, analyzing the potential of using information design as an instrument to interpret data to enrich ecosystems mapping.

2   Approach

To explore if and how the application of a design approach can support the emergence of new inquiries about design, the participatory and distributed approach developed in [7] was expanded to design schools and design professionals. The participation of multiple design stakeholders in data interpretation was beneficial to identify differences and similarities between novice versus expert designers, to explore how

different design competencies can be applied within data visualization (going beyond graphic design), to multiply the interpretations of a single database, and to expand the realm of interpretations to other vectors of the design ecosystem.

In total, 30 students from the Graphic Design and Editorial Projects master course of the Faculty of Fine Arts, University of Porto, plus 30 students from University of Aveiro, in Representation and Knowledge course (year 2020 and 2021), were involved in data interpretation during the period of one semester. An initial brief was shared with the teams, followed by a formal presentation of the dataset they would be working on. Students, under the guidance of the leading professors, were free to add any information from other sources that they could find beneficial for their exercise. They also had to follow the teaching program, with the mandatory use of specific instruments and tools from the information design field.

Additionally, 9 design professionals were invited to participate in data interpretation. Their backgrounds included multiple disciplines from the design area, namely: graphic design; illustration; cartoon editorial design; arts and crafts; and communication design. These authors were from different regions of the country, although most of them are from Porto and Lisbon districts—where the highest percentage of design companies are also established. Moreover, authors included male and female representation to obtain a heterogeneous representation. The briefs were composed by one database, combined with a proposal for a set of indicators to develop the work. The choice of designers and themes was also based on their authorial nature—their strong and recognizable languages supported the creation of a collection of objects that, in turn, can contribute to the construction of the project's memory. Table 1 shows the databases with a brief description. All the data used for this exercise is currently available at the project's website: www.designobs.pt/resources. Table 2 shows a sample of the resulting works.

In total, 41 infographics were designed via the application of the participatory approach: 9 were from professional designers, 18 from Aveiro University (year 2020 and 2021); and 14 from the Faculty of Fine Arts, University of Porto. A preliminary selection process for the students' work was undertaken by their professors, based on the quality of the questions, information and visualizations. The team analyzed each of the works selected, developing an overall analysis of their form and content. Form included aspects such as materials, colors, shapes, icons and metaphors, used amongst other aesthetic elements within the two-dimensional image. The content included the analysis of information displayed versus the datasets that were shared to develop the elements. The following sections present the projects, with a short description of each. The next section delves into the contributions of these outputs to inform the discipline. Moreover, it reflects on the potential of the participatory approach to enrich the representation of the design ecosystem.

Table 1 Databases and brief description

Database	Short description
Design graduates in PT	Has information about graduates in design courses in PT (2002–2020), namely schools, geographical location by NUT II, courses, disciplinary areas, and number of graduates (M/F) per year
Design doctorates	Aggregates information about the PhDs undertaken in PT from 2001 to 2019. There are a total of 249 PhD theses, with information on the authors' names, school, work title, advisors, keywords and URL repository
Design doctorates—bibliography	Extraction of all the design PhD references—the list contains 19,000 lines of information about the authors, year of publication, typology of the reference. It also identifies PT authors
Design faculty in PT	Results from an inquiry to the design faculty of design Schools. Contains sociodemographic information, as well as the background of 196 professors
Design companies and graduates in PT—diachronic vision	Crosses information of the total number of graduates in design, and total number of design companies in PT by NUT II

Table 2 Sample of resulting words—database, title, designers: professional designer (PRO and their background) or design students (STU)

Name of database	Title of work (background, if PRO)	Code
Design graduates in PT	Fabric of design education in Portugal (arts and crafts) Time forms the trunk (illustration)	PRO1 PRO2
Design doctorates	Design doctorates (graphic design) PhD machine (communication design)	PRO3 PRO4
Design doctorates—bibliography	Tugboats (graphic design)	PRO5
Design faculty in PT	This is the last time I represent gender by color (editorial design) Design is not only design (illustration)	PRO6 PRO7
Design companies and graduates in PT—diachronic vision	Design puzzle (illustration/cartoon) Payment, employment and design (miscellaneous) How much a designer is worth Design menu To the point of	PRO8 PRO9 STU1 STU2 STU3
Design companies (year 2018)	Fish design Export on wheels Conquering design	STU4 STU5 STU6

3 Results

This section provides a description of the results obtained, comparing the information design elements used across the two groups. Figure 1 presents the assemble of projects developed by professional designers and design students respectively. A short and more technical project description is provided in Tables 3 and 4. For each project, the main "indicators" used for their creation are identified. The next section of this study (reflection) provides a more interpretative analysis of the research results obtained, looking at the elements, metaphors, colors, techniques and shapes used.

4 Reflections

Considering Design as an activity of cultural mediation developed through artefacts, the application of Information Design as its specialization, has the potential to make sets of data culturally accessible, adequate and relevant. These datasets, by their very nature and/or volume, would be difficult to understand or systematize and, as such, would be useless in the construction of a semantic layer to support properly informed opinions, speculations, and consequently, decision-making.

As mentioned in the previous section, the work of students was selected based on their quality (design and information criteria) by the teachers of the course. Aesthetically speaking, the projects included in this analysis show a large diversity. In some cases, design is used to convey certain information(s) (mostly observed in students' cases), or to emphasize an interpretative view based on data (mostly observed in professional cases).

The gradient of research results regarding interpretation can be explained not only because of the evident gap in expertise between the two groups involved in the exercise (students and professionals), but also because of the context within which the projects were developed. On the one hand, design students had to analyze and translate data via the application of multiple tools and methods from information design, in a learning context, leading to more analytical and objective translation of information into graphical elements and/or diagrams, in most cases. Professional designers, on the other hand, have developed an authorial view of the data, adopting a critical standpoint in most cases, and carefully choose elements, colors, shapes and materials to convey a certain message about the dataset (or a specific indicator). PRO1 for instance has drawn a map of design education in Portugal by crossing stripes of colored paper. The technique used alludes to the idea that education, as a system, is a construction of connections—a weave. The photography authenticates the process: we can observe a falsely two-dimensional map being held by the hand that conceived it. In this technical process, craftsmanship is emphasized, over rigor, metrics, and precision—perhaps alluding to the geographic distribution of schools with design education that doesn't seem to follow a specific strategy. Educational institutions are mostly located near the coastline—whereas the interior and southern parts (Alentejo)
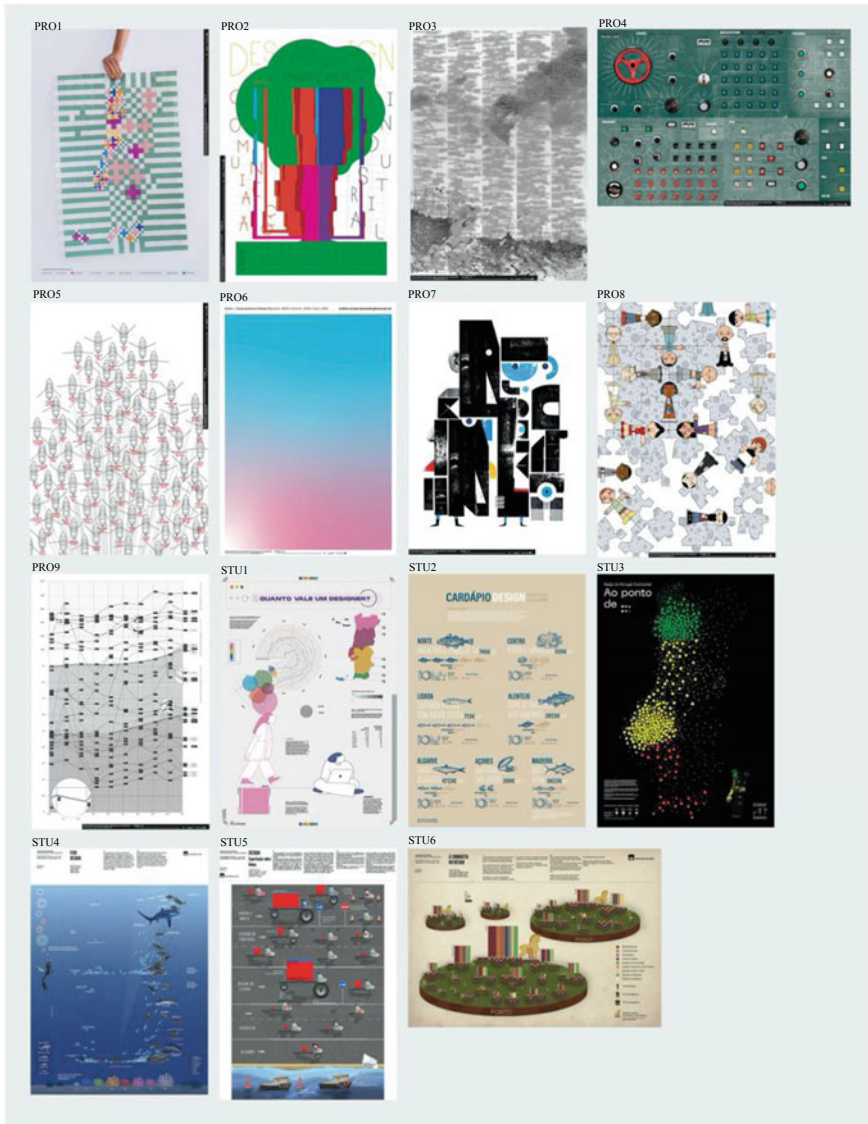
Fig. 1 Results from the professional designers (PRO) and design students (STU), authors/designers: PRO1: ItemZero; PRO2: André da Loba; PRO3: Marta Madureira; PRO4: Inês Nepomuceno; PRO5 Gonçalo Falcão; PRO6: Oupas!Design; PRO7: João Faria, PRO8: SilvaDesigners, PRO9: Cristina Sampaio; STU1: Inês Venâncio, Margarida Silva, Raquel Clemente; STU2: Inês Francisco, Maria Santos; STU3: Gabriela Sousa, Joana Teixeira, Miguel Gomes, STU1-3: under the guidance of prof. Marta Fernandes; STU4: Catarina Matos, Nuno Vinhas, Sofia Nogueiro, STU5: Beatriz Gonçalo, Cláudia Ribeiro, Inês Silva, STU6: Joana Rodrigues, Laura Santos, Sofia Palhinha, STU4-6: under the guidance of professors Rui Costa and Donato Ricci

Table 3 Short technical description of the projects made by professional designers

Project	Short description	Indicators used
Fabric of design education [PRO1]	The project uses paper to represent the distribution of design schools throughout the territory. The proportion of the crosses varies according to the number of graduates within the region. In the cosmopolitan areas, such as Lisbon and Porto, the crosses become smaller, not due to the number of graduates, but because of the density and variety of schools – Link for poster: https://doi.org/10.5281/zenodo.6365031	Number of public and private schools, geographical location
Time forms the tree trunk [PRO2]	The designer presents via a tree-like shape, the foundations and evolution of the CNAEF areas of design (national classification of education and training areas). The middle, with strong, tick lines (high number of graduates) represent the basis of design education. An abrupt change of color occurs in 2014–15, when CNAEF classifications for design change. The sides of the image are composed by thinner lines of information that represent masters and doctorate graduates, with variations of a design area (e.g. industrial design, equipment design) – Link for poster: https://doi.org/10.5281/zenodo.6385284	Design graduates, design courses, design areas

(continued)

Table 3 (continued)

Project	Short description	Indicators used
Design doctorates [PRO3]	The project is based on the analysis of the design PhDs keywords completed between 2001 and 2019. It lists all the keywords ever used within design doctorates, putting them forward, blindly, with no hierarchy. Each doctorate is identified through a number that is hardly recognized – Link for poster: https://doi.org/10.5281/zenodo.6385301	PhD keywords
PhD machine [PRO4]	The project emphasizes the relationship between PhD production and supervision work. The designer uses a graphical organization and specific hierarchy, with multiple types of boutons with various dimensions that detect and reflect on an asymmetry (monumental buttons and small switches) – Link for poster: https://doi.org/10.5281/zenodo.6385307	Supervisors, PhD students
Tugboats [PRO5]	The project uses boats as a metaphor to represent the authors mentioned in the PhD theses. The boats enable a rapid identification of who is on the lead. However, it does not provide the specific profile of the racers. The designer considers the count of the number of PhDs for each author but does not use this information to distinguish the volume of the boats—it seems to privilege the idea of teamwork – Link for poster: https://doi.org/10.5281/zenodo.6344250	PhD references, summary of citations

Table 3 (continued)

Project	Short description	Indicators used
This is the last time I represent gender by color [PRO6]	The project is interesting due to the contradictions contained. The use of color—pink for girls, blue for boys—is used and rejected at the same time (in the title). The designer uses an easy language to convey an idea, however, the title mentions a rejection of the same formula. Although it reduced the data to a bare minimum, the project works with data and interpretation in a balanced way, a formal simplicity: a color gradient – Link for poster: https://doi.org/10.5281/zenodo.6385319	Gender
Design is not only design [PRO7]	It is an elaborate complex puzzle, a body composed of multiple elements, some modular, others irregular, others three-dimensional, which illustrate the different dimensions of teachers' training in Portugal—an area which is multidisciplinary by nature – Link for poster: https://doi.org/10.5281/zenodo.6385327	Teachers' background (areas)

Table 3 (continued)

Project	Short description	Indicators used
Design puzzle [PRO8]	The project seems to convey a message of confusion—an incomplete puzzle, hard to codify, with missing pieces. The author seems to emphasize that it is hard to connect the indicators of design graduates and design companies (here represented with people that have and do not have diplomas) because there is no information about the design graduates that integrate those companies. The content is diverse (with people from different ethnicities, gender etc.) and the visual clues, miscellaneous. Despite the drawings within each puzzle piece (nodes connected to each other)—few links can truly be established

Link for poster: https://doi.org/10.5281/zenodo.6385343 | – |
| Payment, employment and design [PRO9] | The project explores several indicators related with companies, by NUT II regions (North, Center, Alentejo, Algarve and islands). The top part is focused on turnover variation across regions. For instance, the highest turnover in the last year was generated in the North and followed by Algarve. The middle part of the project focuses mostly on the evolution of average salary per company. There are some intersections and a high increase of average cost per employee in Madeira Island (year 2019). The bottom part focuses mostly on medium salaries and their evolution through time. These indicators are compared with the average salary and minimum salary practiced in Portugal

Link for poster: https://doi.org/10.5281/zenodo.6385356 | Number of companies, number of employees, costs with employees, geographical location |

Table 4 Short technical description of the projects made by design students. All posters are available for download here: https://doi.org/10.5281/zenodo.638 5383

Project	Short description	Indicators used
How much a designer is worth [STU1]	The students choose different elements to draw a narrative—each layer of information is autonomous, while also complementary. On the one hand, the round shape emphasizes the diachronic view and evolution of the average salary of employees working in design companies in the regions, through time. Portugal's shape and color are used to inform about the number of companies per region; and another element provides the example of the region: the lowest and highest number of companies and employees per region (Açores and North, respectively). There are some aspects that make global reading difficult. For example, there is a syntax problem in the first graph. By choosing a circular diagram, the students suggest an idea of time cycles which is not the best choice because 2019 cannot go back to 2010. Even the sudden change of scale creates the illusion that there was a substantial increase in the remuneration value—which is not the case	Number of employees, costs with employees, turnover, years (2010–19), geographical location

(continued)

Table 4 (continued)

Project	Short description	Indicators used
Design Menu [STU2]	The project analyses the different regions in Portugal using regional fish-based dishes to provide a geographical reference. They compare the job offers (employees in design companies) to the number of design graduates in 2019, to convey a narrative about the purchasing power of designers throughout the region. The stars are used to classify the "level of effort", related with the purchasing power. This, however, can be a bit misleading since "5 stars", usually associated with quality, is in this case, used as the worst-case scenario (e.g. Alentejo and Açores require higher efforts because the purchasing power of designers, based on the average salary, is low). Graphically, the regions are distributed as a list, likewise the shape of Portugal (North to South and Islands)	Geographical location, year 2019, costs with employees, purchasing power
To the point of [STU3]	This project is composed of different shapes and elements that emphasize the distribution of companies per design area, namely graphic design, interior design, product design and fashion design. A smaller scale of Portugal appears in the right corner of the page, looking at a very distinct distribution of the number of graduates in the country. The project uses color to emphasize the different regions, demonstrating an evident asymmetric distribution between the two indicators. The use of a black background triggers another interpretation—one that shows a different country, with an almost non-existing eastern frontier	Design area, number of companies, number of graduates, type of teaching subsystem, geographical location

Table 4 (continued)

Project	Short description	Indicators used
Fish Design [STU4]	The project features an ocean, with multiple aquatic animals, from different sizes and shapes that allude to the constitution of the Portuguese design industry—a marine ecosystem, where most companies are micro-sized. It incorporates multiple data on design companies to represent a fish ecosystem, namely, operational results in a scatterplot, that distributes the fish. Turnover volume per design area (e.g., communication, graphic, industrial design) is determined by the size and color of the coral. Students choose to separate companies with and without "design" in their name, showing two (almost identical) scenarios	Operational results, size of company, exports per company, number of employees, design area
Export on wheels [STU5]	The project uses the geographical disposition of the territory to represent exports by region, highlighting the importance of a large urban center for the area. The trucks show the cities' colors and symbols; the load represents the number of companies per size; whereas the front and back wheels are used as a symbol to show a proportion between employees that work in companies that export, versus the total of employees. Road signs demonstrate how good or poor certain cities and/or regions are in terms of exports	Exports, number of companies, geographical location
Conquering design [STU6]	The project looks at design companies from the Northern region of Portugal and emphasizes the importance of two urban centers: Porto and Braga, where most companies are allocated. They use "trojan horses" in the design arena to refer to companies that adopt the code of design activity (74.10) but whose products and services do not fit into design (e.g. reprographic/printing companies). The colors in the flags show up to nine different categories for design areas, thus making overall conclusions of the landscape a bit hard. Additionally, the symbol of the men is not entirely objective when allocated to bigger groups	Design area, number of employees, geographical location

of the country continue still with large empty spots. PRO1 and STU1 intersect similar information, being complementary. "To the point of" (STU3) uses an organized, linear, and precise language, defined by the geographical indicator. The visual work intersects graduates and companies, demonstrating through the addition of color on a black background, two different countries, with asymmetrical distributions of resources (design graduates and design companies). A depletion of economic activity associated with design, from the interior of the country, portrayed in the first image (larger scale) is almost directly proportional to the number of educational institutions that teach design courses in mainland Portugal (smaller scale). In this project, a more thorough analysis of the relationship between the two observations could be explored, proposing a more critical reading of the data.

Within the realistic technique, a photographic representation used in PRO4, summons buttons from machines of the past to compose the history of design doctorates and establish connections between universities, supervisors and doctorates. Connections between the elements are composed by what truly "connects"—on/off buttons, alluding to a system out of its time. What the designer seems to think of this asymmetry is stated in the choice of language—a machine that produces doctorates as numbers, with no regard for their content. The very character of the machine is informative, with elements that remind us of late, rigorous, and outdated modernism. In a similar topic (design doctorates), PRO3 could be categorized as something quite far from the territory of information design, and with a greater weight of authorial interpretation—an illustration! The density of information, cloudiness, and lack of clarity of each data line, seem to refer to the same-like feeling of the dataset that gave rise to the project: difficult to segment. It's heavy, dense, but at the same time, poetic. The listing of the keywords is there, but put forward blindly, with no levels or hierarchy, diffused, dark—quite like a programming language.

Additionally, the use of vectors—a rational drawing technique—alludes to a precise placement of the elements, communicating a formal message. PRO5 for example, uses this technique to inform about the most cited authors in doctoral work undertaken in Portugal, in the design area. The representation provides names and countries of origin, enabling readers to identify the authors that are present on more PhDs and even some of the very few Portuguese authors on the race (e.g. Francisco Providência, José Augusto França, António Damásio). The absence of color (except in the names/countries) and the dispersion of the boats (authors), randomly placed, yet paddling in the same direction, reminds the importance of teamwork, independent of nationalities or their times. This metaphor is similar to a system, one that can go even further, with new layers of information—the shape and of the boats could suggest different areas of Knowledge (History, Philosophy, Psychology, the different Design fields, etc.); their colors, another dimension, and the size of the paddles, the type or rowers. Also using vectors, PRO2 (time forms the trunk) uses color to guide the author in the diachronic view of design education in Portugal, comparing it with a tree or plant, with its irregular distribution of growth. For example, showing an important change occurred in 2014–15, with most graduates shifting from communication to industrial design. The numbers and smaller annotations (e.g. design areas) are present but yet, are not very informative given their micro scale. In the same sense,

however, with the annulation of technique PRO6 and sole of color (a chromatic carpet) confirms what we suspected about the gender imbalance in the composition of the teaching staff that ensures education in Design in higher education in Portugal.

In the options guided by aesthetic coding, the authors illustrate the data as much as themselves—"on the unknowns that the currently available data throw on the professional territory of design" (as mentioned by PRO8) or on the "construction of the training path of design teachers" (as mentioned by PRO9)—with images that are tangentially (or essentially) inspired by the data provided. In these two cases (PRO8 and PRO9) the descriptive texts and the titles proposed by the authors ("Design Puzzle" and "Design is not just design") act as a reinforcement of the clues inscribed in their visual discourse to guide their decoding, without, however, guaranteeing it. PRO9 could be an imitation of letterpress—an informal representation of data. A body composed of multiple elements—some modular, others irregular, some flat, others three-dimensional—illustrating the complexity and dimensions of design teachers' training in Portugal, an area made of multiple contributions and different scientific areas. The four senses represented in this illustration underline the urgency to be attentive and sensitive to cultural, social, political, and economic changes. This illustrates the flexibility of those who not only accumulate, but also add and relate experiences, forming a solid but not sealed block of knowledge.

Also, the logical coding shown by the PRO7 and STU1 emphasizes objectivity—they are almost monosemic of the quantification of the designers' payment versus the turnover made by design companies. STU1 and PRO7 denounce the fragile situation in terms of income from work that the Design activity, a scenario which has been maintained or even deepened throughout the last decade in Portugal.

Despite having a more functional purpose, the work of students also presents graphic variety in the structures and diagrams, chromatic and iconic codes, as well as the use of some metaphors to communicate data. For instance, STU4 uses a fish ecosystem to represent a dataset about design companies in 2018. Most of them are micro companies (sardines, in the poster), some with their names for a higher level of information. Some are at the top (with most exports) and many at the bottom (with no exports). STU2, STU5 and ST6 reflect with greater or lesser recourse to a metaphorical language—the numerical and georeferenced nature of the databases that are at their origin. In this set, individual techniques begin to be subjugated to a process of collective discourse, as in a choir—there is no one that stands out so much (group work).

Overall, this project manifests the use of multiple design approaches and techniques. Whereas some designers choose to use partial parts of the dataset to communicate an idea, others give detailed views of the data, crossing multiple indicators. Each author/designer carefully applied his/her perspective and competencies to translate an idea into a bidimensional image, using a solid and crafted visual language. The authorial/professional projects—mostly interpretative—have less use of dense data analysis, when compared to students' projects, almost always sticking to a broader idea. Their diversity of responses remains a central point, with a wide difference in language, precision of information and messages.

5   Conclusions

As noted by Alberto Cairo [13], information design projects seem to develop in layers that can comprise a more general interpretation (usually emphasized through a visual language); followed by general information and, finally, specific details. Fifteen visual projects are presented in this chapter, translating the graphic interpretations proposed by designers about the characteristics they considered most relevant in the data collected and curated by the DesignOBS.PT project, concerning different dimensions of the Portuguese Design ecosystem. The visual works collected from the application of a distributed and participatory approach to analyze and interpret databases are the result of an unusual exercise—having designers look and interpret their landscape, and themselves indirectly. From this point of view, it is a truly original set of representations and one that is expected to encourage other reflections and productions capable of maintaining a dynamic portrait of the design discipline in Portugal.

This study also has limitations, which in turn, indicates directions for future work. First, the interpretations of the visual works above presented were restricted to the members of the DesignOBS project (authors and co-authors of this chapter). The team members have diverse backgrounds that include graphic design, industrial/equipment design, editorial design, as well as engineering design and programming—this enables a broad analysis of the form/content of each work, however, next steps should capture how other design stakeholders, with other backgrounds (with or without design knowledge) and no previous knowledge about the datasets, make their own interpretations of these information design projects. Capturing their different interpretations, could improve the robustness of this study, to validate and expand design knowledge.

Second, due to time restrictions, the professional designers and design students' thinking process and intent for each design decision was not included in this work. A set of interviews is being undertaken to follow-up the multiple challenges that have emerged from working with data. A partial view of these results was already captured in Costa et al. [7] with design students. However, additional data collection is needed to explore how professional designers addressed the challenges of working with data, as a source.

Third, each work presented in this chapter has been developed based on one database which focuses either on design education, design research or design (related) companies through its economic activity code. Future research should increase the spectrum of interpretations to other vectors of the ecosystem (promotion, actors, users etc.). Additionally, it should also explore if and how design, as a leading approach to map ecosystems, can be used at the macro level, to analyze, interpret and map the multiple vectors; as well as delving into the main differences and benefits of using this approach to support informed decision making.

Finally, we believe this study constitutes an important step to mature a distributed and participatory observation approach that has been developed within the Design OBS project. It presents projects that use design as the leading approach to map

data about the vectors of the design ecosystem in Portugal, focusing on education, research, and industry. The study contributes to design research, providing an empirical application that can be used to develop future research at the intersection of design, information and data.

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Growing Knowledge Across Boundaries: Lessons from a Multi-Actor Design Project

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Abstract It is widely acknowledged that projects that seek to address complex socio-technical problems benefit from a deliberate mix of individuals, whose complementary expertise and skills can be leveraged in service of the project goals. Three ways through which this team diversity can be achieved are through industry-academia collaborations, through combining various disciplines, and through the inclusion of individuals with different levels of proficiency in their field. This chapter takes a critical retrospective look at a recently concluded collaborative project, which integrated these dimensions of interest. Ostensibly, that project aimed to design devices for smart and connected cycling. However, in this chapter, it is taken as a case study for a post-project review by its team members. We provide a detailed description of this multi-actor team, the design brief, work process and outputs, alongside the findings from a reflective questionnaire. In doing so, we aim to contribute to informing best practices for future heterogeneous collaborative projects through the lessons we learned here.

Keywords Design for smart mobility · Industry-academia collaboration · Interdisciplinary design project · Knowledge boundaries

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1 Introduction: Complexity, Collaboration, and Crossing Boundaries

Design deals in complexity and messiness. Alongside societal and technological advancements that have added layers of complexity to design problems over time, the scope and reach of design have also grown [1]. It is in responding to increasing complexity, diversity, and uncertainty that design finds its vocation as a driver of innovation. The prevalence of fuzzy and seemingly unsolvable problems, often described as 'wicked problems' [2], has helped forge design as a discipline that is uniquely placed to address them [3]. Design, in turn, has evolved to challenge increasing complexity. One particularly helpful model for conceptualizing this evolution is provided by Jones [4], who sees the discipline as moving away from Traditional Design (phase 1.0), through Product and Service Design (phase 2.0) and Organizational Transformation Design (phase 3.0), and towards Social Transformation Design (phase 4.0). That author argues that to advance in these design phases—and consequently to broaden design's real-world impact—demands different mindsets, value propositions, disciplinary composition, and skills. Indeed, many have made this call for purposeful collaborations across organizations such as Industry-Academia Collaborations (IACs) [5], across disciplines [6, 7], and across levels of expertise [8, 9].

The collective knowledge of such heterogeneous teams is widely expected to yield various benefits, including but not limited to expanding the range of ideas and informing more creative solutions [10–13]. Yet these broad teams are not without their own complexity and there are inherent challenges to their effectiveness. This is because knowledge is situated [14], which means that it is generated and used by communities of practice, characterized by their own historical, cultural, linguistic, and value context. As an example, the particular knowledge held by designers has been termed "designerly ways of knowing" [15]. The notion of knowledge boundaries is intrinsically tied up with this specialized knowledge, which is not always smoothly accommodated by other practices. Carlile [16] describes three principal types of knowledge boundary. First, a syntactic knowledge boundary happens when there is no shared syntax, thus fostering concern that information is not properly processed across a given boundary. Second, a semantic knowledge boundary happens when, even though there is a common syntax, differing interpretations of the common syntax make communication and collaboration difficult. Third, pragmatic knowledge boundary happens when actors are resistant to transforming their existing knowledge and skills to achieve a common goal.

But knowledge boundaries are not unsurmountable. The concepts of boundary crossing objects [17, 18] and individuals [19] have been explored as ways to negotiate these knowledge boundaries. These constitute artifacts or people that are flexible enough to allow different groups to work together without consensus, but also robust enough to maintain a common identity across different contexts [18]. Boundary objects need not be tangible and may include figures of speech or renaming a concrete phenomenon in a metaphorical manner, especially in the sharing of tacit knowledge

and understanding between people [20]. More recently, it has been noted that a design approach itself can serve as an interactive boundary object, as it facilitates interactions across disciplines [21]. These are concepts that we use in this chapter to reflect back on a recently concluded project that was purposely devised in three core respects: (i) it brought together industry and academia capabilities in the form of an established technology development organization and a university; (ii) it combined individuals from diverse engineering and design backgrounds; (iii) it leveraged novice-expert interactions through the inclusion of individuals at differing levels in their career. The research team was therefore uniquely placed to critically review the project after its conclusion.

Successes and even mistakes are worthwhile when one can learn from them—and share those lessons with the broader scientific community. With that in mind, we conducted a mid-term project review, from which we derived five recommendations for similar projects in the future [22]. The current chapter builds on that work through a more in-depth post-project review, which is detailed and discussed in Sect. 3. In Sect. 4, we present the lessons we learned from this process and briefly discuss them in Sect. 5. In the following section, we begin with an in-depth description of the collaborative project, its diverse actors, opportunity, design brief and outputs.

2 Case Study: Designing for Smart and Connected Cycling

2.1 Actors and Context

This case study involved one academic and one industry partner—University of Minho and Bosch Car Multimedia, respectively. The undergraduate degree in Product Design at the University of Minho has actively promoted collaboration between academia and industry since it was established 10 years ago, with the first integrated industry placements commencing in the 2014/2015 academic year when the initial lot of students reached their final year. The final semester of the six-semester Product Design syllabus comprises this work placement, which is largely embedded within a local partner industry. The project described in this case study involved two final-year Product Design students who were undertaking a work placement at Bosch Car Multimedia. During their industry placements, these students' work was overseen by a senior academic tutor (Design) and an industry tutor (Engineering). This work placement was set within an existing co-promotion programme between the University of Minho and Bosch Car Multimedia called Easy Ride, which afforded the addition of two postdoctoral design researchers. The team included a further two senior academics (Engineering), who were involved as project manager and company representative. Table 1 summarizes and highlights the diversity of this eight-person team as an interdisciplinary IAC, involving people with varying levels of experience.

Table 1 Summary of team composition

Institutional affiliation	No. of team members
Academia	4
Industry	2
Academia-industry internship	2
Disciplinary background	No. of team members
Design	5
Engineering	3
Number of years' experience	No. of team members
0–3 years	2
4–9 years	3
10 or more years	3

The purpose of Easy Ride was to advance the state-of-the-art in smart sensors, human–machine interfaces, and vehicle-to-everything (V2X) communication infrastructures, with a view to developing innovative solutions for future smart mobility. Within this broad programme, the work described herein fell under the Connected 2Wheelers workstream that aimed to develop new technology-enabled services for urban mobility on two wheels, in this case focused on urban cycling. The duration of this particular collaboration was relatively short—it lasted just over nine months overall, with the students' work placement lasting 15 weeks. In addition to a small but heterogenous team and the short timeframe, it is worth noting that this collaboration happened under unprecedented circumstances. Having taken place in 2021, amidst the global Covid-19 pandemic, the work process was constrained by the public health measures in force such as lockdowns and recommendations to work from home whenever possible.

2.2   Design Brief

Each student worked on a discrete design project. The development of the design brief for each project preceded the broader collaboration described here, although the two students were involved throughout. In the academic semester prior to their work placement, in a taught module called Innovation and Quality, the entire final year class worked in groups to explore the smart and connected cycling problem space. Eight design concepts emerged from this group work, which were presented to Bosch Car Multimedia. Of these, two design concepts were chosen by Bosch Car Multimedia for further development during the student work placements.

The **Bike LEDs** project aimed to develop low-cost and low-resolution LED displays to attach to the bicycle, which could work autonomously as well as in connection with a smartphone and other smart cycling devices. It was envisaged that they should be programmable via smartphone and could therefore be a fairly simple

interface. Alongside the design of the actual display, this project contemplated the exploration of low-resolution LED-based visualizations of information relevant to urban cycling.

The **Sensor Box** project aimed to seamlessly integrate a combination of sensors onto the bicycle, to enhance the cycling experience and collect data to support smart mobility more broadly. The number and type of sensors to be included would be determined in function of acceptable and desirable functions for cyclists. Preference was given to a device that could be retrofitted onto existing bicycles rather than incorporated into a new bicycle design, as this would help keep the device costs down and reach a wider audience.

2.3 Design Process and Outputs

The Double Diamond model, developed by the Design Council in 2004, offers a tried and tested process for engaging diverse stakeholders—both designers and non-designers—in design and innovation. This model comprises two conjoined diamonds, the first of which aims to comprehensively understand the problem and the second aims to identify a meaningful solution. Each of these diamonds begins with a divergent, opening up phase and is followed by a convergent, narrowing in phase. This model served as the basis for our work process, which has been described in detail elsewhere [22]. Table 2 provides a summary of what was involved and what was developed in each phase.

Meetings were held frequently, although not always with the involvement of all team members. Importantly, everyone participated in the project kick-off meeting, which was key for discussing project aims, for outlining the project coordination

Table 2 Summary of design process based on the Double Diamond model

Phase	Type of thinking	Methods and techniques	Outputs
Discover	Divergent	Competitive market analysis Brainstorming Mental maps Affinity diagram User survey	Internal report on findings
Define	Convergent	Personas Participatory problem definition (pros and cons)	Four personas Requirements Final design brief
Develop	Divergent	Ideation sketches Rapid prototyping	Multiple design concepts
Deliver	Convergent	Prototyping Rapid testing 3D rendering	Technical drawings Prototypes Storyboards Final report

approach, and for agreeing on the overall design process. There were three subsequent project progress meetings, which involved all team members. These were held at the end of the Define phase when the problem had been robustly defined, at the end of the Develop phase to critically discuss the array of solutions, and finally at the end of the Deliver phase when the refined design concepts were presented. These meetings provided the amplest occasion for knowledge transfer between industry and academia, across the various disciplines involved, and among the various levels of expertise. On a weekly basis, there were meetings involving the student interns (Design), their industry tutor (Engineering), and a postdoctoral researcher (Design), and meetings between the student interns and their academic tutor (Design), with the occasional involvement of a postdoctoral researcher and the University of Minho coordinator (Engineering). Other synchronous meetings were held as appropriate and in response to arising needs experienced within the team.

Most of the meetings were conducted online, owing to the constraints of the pandemic and related public health guidelines. However, the student interns were able to visit Bosch Car Multimedia on several occasions and liaise directly with their industry tutor as well as other Bosch Car Multimedia employees, who were then able to showcase their work first-hand. Remote collaboration among the various team members was ensured through the use of various digital tools, such as video-conferencing software, shared written documents, and online collaborative whiteboards.

2.4   Design Concepts

Two final design concepts were developed. Although the purpose of this chapter is not to evaluate the final design concepts per se, they cannot be dissociated from the process through which they were generated. After an exploration of device form and interaction modalities (Fig. 1), **Bike LEDs** resulted in an interface to be used primarily for navigation and road safety.

The low resolution of the envisaged LED displays necessitated a study of minimum perceptible information, organized on a LED matrix, as well as the use of colour and light position to aid communication (Fig. 2).

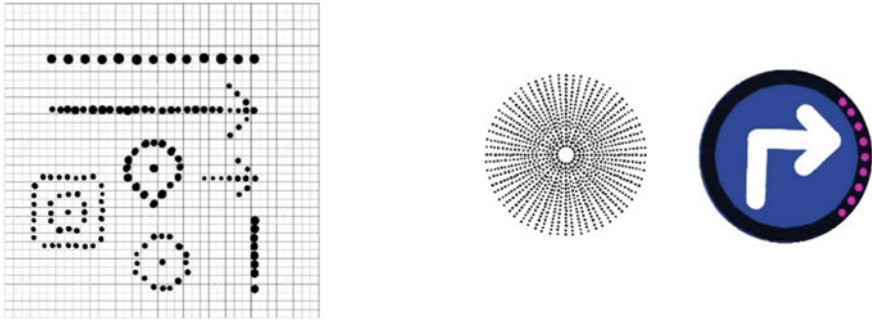**Fig. 1** Preliminary Bike LEDs design concepts

Fig. 2 Study of minimum perceptible information on an LED matrix, on the left, and use of colour and light position, on the right

The final **Bike LEDs** prototype was robust enough for rapid user testing of bicycle installation and use while cycling, namely of warning lights (Fig. 3). However, device programming and full information visualization were not feasible within the project timeline.

Sensor Box went through multiple iterations until it reached its final form as a device to be attached to the back of the seat post. Initial explorations investigated the possibility of incorporating the sensors into the seat or elsewhere within the bicycle frame, but eventually a separate box was deemed a better solution as it would enable easy transfer of the device from one bicycle to another. This was a user requirement that emerged from the research undertaken in the Discover phase, as survey respondents mentioned bike sharing practices as well as having different bikes for use in different contexts. The final housing for the sensors was a polyhedron (Fig. 4), incorporating a warning light for better visibility on the road.

The size and shape of **Sensor Box** were to some extent constrained by the sensors to be included in the device. An additional concern was sustainable and low-cost
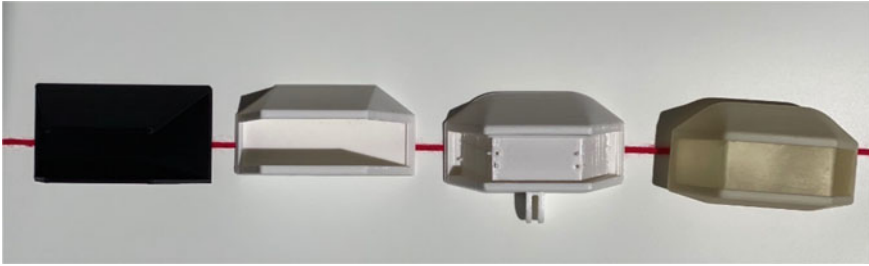
Fig. 3 Final bike LEDs prototype in use

Fig. 4 Construction of the Sensor Box housing prototype

energy supply for **Sensor Box**, which motivated the study of smart materials for energy harvesting. It was envisaged that smart textiles could be incorporated into a seat cover, with a view to powering **Sensor Box** while the bicycle was in use (Fig. 5).

We make no substantive claims as to the quality and maturity of these design concepts. The short duration of the project as well as the student-interns' commitment to meeting the academic deadlines of their course naturally impacted on the refinement of the final concepts. Instead, we offer these here as examples of design artefacts that facilitated the articulation and communication of knowledge within this heterogenous team. The presentation of the design concepts at their various stages of development to all team members, along with other outputs summarized in Table 2, provided tangible mediums through which to interpret, internalise, and understand unfamiliar or emergent issues. These are therefore a selection of the many boundary crossing objects [17, 18] that were developed and used during the course of the project, but more importantly they demonstrate that design has a significant role in this domain [20, 21].

Fig. 5 Sensor Box prototype with energy harvesting seat cover

3 Post-project Review

3.1 Rationale

There are many approaches to critically reflecting on a finished project, to distil the lessons learned into information that will benefit future projects. Disterer [23] noted a significant trend in the literature towards seizing the conclusion of a project as a key opportunity for identifying new knowledge and for preparing such knowledge for transfer to other projects. The same author lists in excess of fifteen terms used to describe various forms of post-project assessment, including experience retention, project post-mortem review, and debriefing. They differ fundamentally in terms of their focus, with some approaches looking at process, others at outcomes, and others still at real world use or impact. Heeding Disterer's advice that 'lessons learned' provide a particularly valuable approach to uncovering implicit knowledge, the work described here positions itself as a post-project review. This approach, which endeavours to capture process knowledge, is one of the most structured and widely applicable ways of generating a legacy of experience from one project to the next [24].

However, despite a general acceptance of the value of post-project reviews for competence building and for increasing competitive advantage, they are seldom carried out in a meaningful way. Factors that typically impede this process include a lack of time, interest, and ability, particularly as there are no established guidelines on how to effectively conduct such reviews [24]. As a result, when they do occur, they tend to be undertaken for larger projects and often on an ad hoc basis. Others have discussed the importance of achieving a balance between the speed and the trustworthiness of reviews [25]—while a quick turnaround is necessary to ensure knowledge is appropriately transferred to a new context, achieving this should not compromise the credibility and usefulness of the findings. It is therefore essential to conduct such reviews in a conscientious, systematic, and consistent manner.

3.2 Method and Procedure

A questionnaire was developed for the purpose of conducting the post-project review. After a team discussion, a questionnaire was deemed the most appropriate method because it would provide some degree of anonymity to respondents and thus allow all opinions to be heard equally. This questionnaire encouraged respondents to reflect on the lessons learned during the course of the project and was structured according to the three significant characteristics of the team, elaborated on elsewhere [22]. Specifically, the questionnaire probed what individual lessons had been learned from working in a team comprising (i) an industry-academia collaboration, (ii) multiple disciplines, and (iii) different levels of proficiency. Respondents were also asked to provide examples that illustrated their experiences in these three domains. An

additional fourth section allowed respondents to give any other feedback regarding the project and the questionnaire itself.

The questionnaire was piloted externally, and minor modifications were made to improve its clarity. The final version of the questionnaire was circulated via email to all team members, one month after the conclusion of Easy Ride. The compressed timeline of this post-project review means that it can be classified as rapid [26].

3.3 Ethical Considerations

Conducting this type of critical self-reflection is not without its unique set of ethical challenges. Others have noted that participant identification is a significant risk when conducting research within a small community and that taking the usual steps to safeguard participants' identity, such as pseudonymization, may not be sufficient to maximize anonymity [27]. A fear of being identified or identifiable may, in turn, inhibit candour when sharing feedback and even discourage participation altogether. Moreover, it has been observed that the direct involvement of top management in post-project reviews might inhibit open and frank discussions of any challenges faced [24]. For this reason, only two post-doctoral researchers were directly involved in data collection and analysis. Directly identifiable information, such as names and emails, were not collected. However, institutional affiliation, disciplinary background, and level of experience were recorded and could make recognition possible. Therefore, the decision was made to omit such information when reporting the findings, unless deemed particularly relevant to the purpose of this chapter. The questionnaire was voluntary and respondents were informed that they could withdraw at any time, without giving a reason, and without repercussions to themselves. Additionally, to avoid any perceived coercion, project members were invited to respond to the questionnaire only once via email and no follow-up reminders were sent to those who did not respond.

4   Lessons Learned

Six of the eight team members responded to the post-project review questionnaire. While this number does not represent the entire team, there was at least one respondent from each of the categories of interest to this chapter: industry and academia; both disciplines involved; all levels of expertise. We therefore argue that these responses are sufficiently representative of the team's perspectives and experiences within this collaboration.

4.1 As an Industry-Academia Collaboration

It was evident that industry and academia operate according to different (but often complementary) objectives and under different constraints. This was experienced as seemingly discrepant expectations and priorities. One of these differences was time allocation for certain activities. For example, although research was acknowledged as important for both partners, for some of the academic team members it was envisaged as a primary activity to be sustained throughout the project. One of the respondents mentioned that efficiency was a key concern for the industry partner, namely regarding human resource management to support the student-interns within the company. In this context, time was used more purposefully and tasks were more rigorously planned. There was also a sense that academic responsibilities were well defined from the start, whereas the industry partner had to navigate the more ill-defined aim of promoting proximity with the professional world. The lesson for similar collaborations in the future is to determine a cohesive strategy from the outset that represents the shared goals that originated the collaboration, which should likewise be objective and assertive enough to prevail over the individual agendas of each of the institutions involved.

Communication worked fairly well between the industry and academia partners. This was, in part, due to the frequency of meetings—weekly at first, and then fortnightly. One respondent described this as challenging and stimulating. The meetings benefitted from having clear objectives and were seen as especially effective when they involved the tutors from both industry and academia, because information could be articulated and clarified at point of contact rather than filtered through relay processes. Synchronous meetings were described as an opportunity for mutual learning and expedited decision making. In terms of mode of meeting, opinions were divided but there was consensus that online and in-person meetings were not the same. On the one hand, it was acknowledged that the online format could be more tiring, it potentially involved adaptation or learning of new tools and processes, and hindered informal and spontaneous interactions. Online formats also did not work so well for fully experiencing tangible artefacts such as materials and prototypes. On the other hand, this kind of remote but real-time contact was seen as an important enabler of inclusivity because it allowed people who might otherwise not be able to work together to do so. From here we can conclude that communication is effective when it is frequent and focused, when it is conducted in real-time, when it involves team members that represent different institutional interests, and when it is sufficiently flexible to accommodate in-person as well as remote participation.

Interestingly, when asked about differences between industry and academia work practices, two team members felt that this was not the most significant difference they experienced during this collaboration. Indeed, some team members already had considerable experience in this area. These respondents felt that disciplinary differences between design and engineering had a greater impact, especially in terms of notions about products and solutions, and the role of designers within this

process. Nevertheless, these differences were considered meaningful opportunities for exploration and potential innovation.

4.2 As an Interdisciplinary Team

This collaboration had a strong focus on product development. This naturally emphasized various (arguably not unfamiliar) differences between the disciplines involved. In the words of one team member, "the disciplinary differences—design/engineering—in this project were felt as they always are in other projects." Engineering was perceived as being driven by a technology push ("What can we do with this technology?"), whereas design sought to understand and respond to real-world needs ("What can technology do for people?"). This was evident in statements made about design concepts having been constrained by available technology. A typical approach described for engineering would be to list a number of product design alternatives and identify how they could be evaluated against a set of desirable criteria, which would then reveal one or more optimal solutions for specific usage scenarios. Engineering was described as effective, but perhaps to the detriment of elements conducive to a positive user experience. Design was perceived as having a holistic role in innovation, beyond merely solving (technological) problems, but this kind of approach takes time. As a result, there was a sense that expectations needed to be managed in terms of what could be considered outputs of the design process and when they might be produced.

The design tools and techniques proved to be instrumental in bridging the gap between disciplines. It was acknowledged that using the Double Diamond model had galvanized the interdisciplinary collaboration, because it set out a clear and actionable structure for the work to be developed. The use of the Double Diamond, in conjunction with the work of the dedicated postdoctoral design researchers, was an innovation in relation to other Product Design work placements, which had predominantly focused on achieving pedagogical and academic objectives. This very chapter and the post-project review that informed it are fruits of the design research that has continued beyond the project completion. But other outputs generated during the course of the collaboration, such as the questionnaire results and the personas (Table 2), also served an important purpose in terms of overcoming disciplinary misgivings and provided a concrete medium for sharing knowledge, for stimulating discussion, and for informing team decisions.

In addition to these objects, there were boundary crossing individuals within this collaboration. Most notably, the student-interns (Design) played an important boundary crossing role. This occurred organically as they were more directly involved with the company. In fact, Bosch Car Multimedia made a concerted effort to identify its key engineering specialists to liaise with the student-interns, namely in the areas of mechanics, materials, hardware, and software. Through these interactions, the student-interns were able to obtain the technical knowledge directly from these specialists, which they then integrated into their work. However, there was a sense

that the student-interns may not have been the most appropriate individuals to undertake this role—at least not in such an unstructured way. They occasionally got caught between seemingly contrary views and, as the most junior team members, struggled to unpack the knowledge from the noise. The power structure of the team may also have undermined the student-interns' authority to fully take on the responsibilities of boundary crossing individuals. Even the postdoctoral researchers (Design), who were more experienced and therefore better equipped to deal with this role, did so more in a responsive rather than systematic manner. This suggests a need for careful planning around this type of role in future projects, including who is best placed within the team to take it on. This kind of forethought might enable the creation of clearer pathways for communication and knowledge growth.

4.3   As a Heterogeneously Skilled Team

Perhaps unsurprisingly, this was the more familiar type of team diversity, with one team member noting that "this combination is common in my experience—so it is not easy to separate what happened in Easy Ride from other projects." Nevertheless, this dimension also brought salient lessons that are worth sharing here. More senior team members were perceived as contributing their established expertise and thus grounding the work in the real world. On the other hand, the relative lack of real-world experience of the more junior team members was seen as contributing to a greater openness to new idea generation, as they were not burdened by technical or business constraints. In the words of one team member, the combination of various skill and experience levels within the project was viewed as an effective way to either "discard presented proposals, or support them more robustly." Another respondent felt that, despite more senior team members having a broader and more consolidated knowledge, the junior team members benefitted from having a more dedicated focus within the project (i.e., free from other professional demands of more senior team members) and were therefore more engaged in their own knowledge creation. For example, the student-interns benefitted from direct contact with (non-academic) professionals within Bosch Car Multimedia, who readily shared their knowledge and other resources. The student-interns then shared this knowledge with the rest of the team orally in meetings or through other outputs (Table 2), which incorporated and translated the knowledge into meaningful mediums.

It was noted that this type of diversity within the team could be a source of conflict. While less experienced team members tended to seek certainty and validation for their work, more experienced team members were prone to critically questioning things—not necessarily reflecting bad work, but as a way to assess alternatives and therefore reach an optimal solution. This process could be a source of anxiety for more junior team members, if they did not receive some form of "confirmation that they are on the right track." On this matter, one of the respondents reflected on the inherent challenges of encouraging novices to freely explore the problem space and to take ownership of decisions that move the project forward, when they are primarily

concerned with fulfilling "what is expected of them." This was particularly true in this case because of the short timeframe of the collaboration and the different interests of the actors involved. One possible solution, identified by a junior team member, would be to include more structured learning opportunities to complement learning-by-doing. This was in line with the views of another respondent who observed that the technical training provided by the Bosch Car Multimedia team had not only brought new knowledge to the student-interns, but also helped to build their confidence.

Overall, the different skill and proficiency levels of the team afforded an appropriate allocation of resources to the planning, management, and monitoring of the work, as well as to responding to the design brief and overarching objectives of the collaboration. This was a novel aspect of this edition of the University of Minho's Product Design industry placement, facilitated by the inclusion of dedicated post-doctoral design researchers. Various respondents mentioned that being a part of project management activities, having the opportunity to contribute to a peer-reviewed paper (published and presented earlier), and then reflecting on their experiences after the project's conclusion were particularly noteworthy examples of skills development for students at this level. The integration of team members with varying levels of proficiency and the specific approach to promoting collaboration amongst them meant that they were able to learn from each other and to grow their knowledge base.

5   Discussion

This work aimed to capture the lessons learned from a recently concluded collaborative project, which sought to develop new technology-enabled services for urban cycling, through the retrospective reflections of its team members. This project is taken as a case study that incorporates three dimensions of interest, which we argue have the potential to bring together the different mindsets, value propositions, disciplinary composition, and skills in what Jones [4] has deemed a fundamental step to broadening design's real-world impact. Specifically, this case study illustrates an Industry-Academia Collaboration [5], a collaboration across disciplines [6, 7] and across levels of expertise [8, 9]. Given the multitude of approaches to critically reflecting on finished projects, we agree with the recommendation of Disterer [23] that 'lessons learned' offers a valuable approach to uncovering implicit knowledge and we therefore adopted a post-project review approach in this work. Our lessons learned, organised thematically according to the three aforementioned dimensions of interest, demonstrate how knowledge grows across boundaries in a multi-actor design project.

Some strengths and limitations need to be considered when interpreting our work. The post-project review was identified as particularly suitable because of its structured approach to capturing process knowledge and because of its wide applicability in generating a legacy of experience from one project to the next [24]. The decision

to use a questionnaire to collect such reflections was not made without first carefully considering other options, namely individual semi-structured interviews. Ultimately, we felt that the questionnaire provided the best balance between providing some degree of anonymity, encouraging candour in the responses, and obtaining interesting insights into the experiences of the team members. It also permitted a relatively rapid turnaround [26], thus overcoming one of the known barriers to undertaking such reviews [24, 25]. Six of the eight team members responded to this questionnaire, with at least one respondent from each of the following categories represented: industry and academia; both disciplines involved; all levels of expertise. We therefore argue that these responses are sufficiently representative of the team's perspectives and experiences within this collaboration.

In conclusion, this work demonstrates the feasibility of conducting a systematic and timely post-project review on a small-scale design project. Here, we have provided a detailed description of the collaborative project, as well as the post-project review process and lessons learned. This post-project review was conducted in a relatively short timeframe with a view to enabling knowledge to be appropriately transferred to a new context, but it also observed recommendations to follow a conscientious and methodical approach so as not to compromise the credibility and usefulness of the findings [25]. We believe that this work makes a significant step in overcoming the lack of established guidelines on how to effectively conduct such reviews [24]. While it is too early to comment on its value for competence building and for increasing competitive advantage, we are encouraged by the fact that the team members who participated in this process reported having gained new knowledge that they would take forward into future collaborative projects. We see great potential to build on this work, including teasing out the limits and criticalities of the heterogeneous dimensions that guided this project.

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Design in a Post-pandemic Era

Francisco Paiva

Abstract This paper reflects on some of the civilizational challenges enlivened by the post-pandemic context, thus playing a role in understanding the current crisis though other key moments in recent history that restrained design at the theoretical and operative levels, having an impact on several social domains. It draws a parallel between how the increasing digitalization changed both the profession and how research is performed though a change in the perception of society and the designers themselves regarding their sphere of activity—be it through spreading design to areas that once were out of reach or through an increasing emphasis on the performance of communication and interaction devices that were shaped and projected by the design industry to strive for a future. This future deploys aesthetics together with environmental and ecosystemic ethics, while adapting the policies of body and space, both private and public, but also of the spirit, thus transforming the perception of temporality itself. Lastly, this article sets out to reflect upon design, using as a starting point the energetic issue and the consequences thereof on creativity and geographical, biophysical, climate, and physiological processes, to appeal to a certain heterodoxy, which can lead to a counter-hegemonic transition that will have a relevant impact on the planetary system.

Keyword Design for transition · Post-pandemic crisis · Design driven innovation · Digital services

1 Crisis

The magnitude of the challenges that humanity faces in the aftermath of the pandemic that still ravages us, together with society's expectation of design's performance in the 21st century in improving the quality of life and social innovation, imposes on designers an approach to multiple and diverse scales, an unprecedented zooming ability, coupled with the ability to establish analogies between problems, processes,

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and disciplinary fields that are progressively hybrid and complex. Contemporary Design is expected to be able to deal not only with complexity and contradiction, as Venturi and Scott Brown proposed in their time, but essentially with "ambiguity", says Stephen Anderson in "The Future of design" [1], appealing to the non-linear and rhizomatic sense of cultural processes.

Society, economy, industry, communication, and culture have all changed, due to increasing digitalization, the restrictions imposed by the SARS CoV-2 pandemic and, recently, with the whole set of perplexities (and deaths) generated by the Russian invasion of Ukraine, which is very much in the domain of the dispute of the imaginary, the symbolic, content, and communication, progressively dependent on the design of multimedia interfaces, which has also become a crucial battlefield.

In this context of catastrophe, design needs a growing capacity to deepen critical thinking in the face of new programs and to develop new operative skills that reinforce the relevance of its field of activity, beyond the traditional market dimension. The progressive digitalization of life, makes the ability to act and interact within the parameterized spectrum of HCI (Human Computer Interaction) technological devices, their metrics, databases, UI (User Interface) models and UX (User Experience) interaction patterns, realizing the interference of AI (Artificial Intelligence) in the algorithmic configuration, combinatorial and progressively more sophisticated parameters that govern and condition the information, beyond the simple graphic and visual aspects, enriching the lexicon, but also the centrality of design in the field of responsiveness and understanding, not only "how to do it" but if "we can do it" and "at what cost?" Design 3.0 is concerned with the system behind the scenes, how different aspects relate to each other, and lastly, the very structures and services of facilitation.

This whole new syntax and paradigm shift was accelerated by the pandemic, which had repercussions in changing patterns of action and brought into play visions and mental models that altered social routines, professional practice, production, themes and processes of research and education in and through design—starting from (self) imposed lockdowns and the necessary observance of other norms of social relationship.

There is a correlation between times of crisis, creativity, and change in ways of life. This interdependence inspired in the past some premonitory manifesto-texts, of which Design For The Real World [2] by Papanek is a paradigmatic example, in its indexation of obsolescence, the social responsibility of design, and its inevitable ecological implication. A concern that became very clear with the multiple reactions to the 1973 oil crisis, whose dynamics finds parallels in other key moments later on, such as the cultural and social transformations that occurred in the first quarter of the 21st century, thinking specifically of the subprime financial crisis of 2007–2010, which changed many life and investment priorities, the climate crises, which raised awareness of the impending ecological catastrophe, and the consequent spread of theories and activism around the Anthropocene Epoch, making designers more aware of the irreversible impacts of the productive, cultural, and social dynamics of which they are a part. It has also brought to light the side effects of climate change on migrations on a global scale, widening the potential spectrum of design's action. In

fact, the perception of massive transformation has increased critical consciousness and promoted the intersection between culture, humanities, arts, and environment, thus changing the logics of visuality and the politics of representation and the very ecology of media [3].

2 Digitalization

With the assumption of software as the central tool of design processes, there is a universalization of cultural phenomena, affecting the capacity to store, to communicate, and even to imagine, changing the very notion of "media", which becomes almost synonymous of software [4]. However, if this aspect tends to harmonize procedures, it also shifts the designer's action from the strict context of the specialist and liberal service provider to the demands of facilitation, programmatic coordination, and art direction.

Digitization has extended to all domains, from mass manufacturing to DIY (Do it yourself) practices, from the creation of the intangible to the cartography and heritage preservation of memory, increasingly converted into data containing infinite information potential. This omnipresence has modified our perception of reality but has also had repercussions on the way design has come to create realities, dependent on the permanent negotiation between the realms of the virtual and the material, which alters the physical limits of the real, of which the progressive volatility conditions the operation and programming of our own perception. Augmented Reality (AR), according to the social media platform company Snapchat, goes far beyond a camera and glasses that record or reproduce—it is a device that enhances the experience of communication, posing the challenge of designing and creating native products for AR, as advocated by Lieberman [5], and already follows some luxury brands, which move from viewing products, to the involvement of the customer throughout a holistic narrative and interactive process. This integration causes the diffusion of boundaries between the visual, spatial, and material domains of design itself, leading companies like ARtillery Intelligence: Metaverse Research and Insights [6] to develop integrated solutions.

All these transformations are dependent on technological vertigo and occur at a progressively accelerated pace, emphasizing the curve of humanity's "evolution" at an unprecedented rate. This is a process that Virilio [7] calls "dromology", resulting from the progressive instantaneity of "Real Time" as a process strongly dependent on technological mediation, which erases the present and retracts the presence of the human. Virilio [8] had well recognized that speed is political—it implies a change in the logistics of perception, a suppression of distances, an almost denial of space and the imposition, as a rule, of the permanent state of urgency.

Questions arising from the reflection on the models of mass production, proposed by Archigram and Archizoom or Superstudio and *tutti quanti*, brought design closer to science-fiction, to which the artistic institutions themselves, led by MoMA, from 1972 on, gave prominence. The implication of these dynamics in political economy

(Baudrillard, Dorfles), urban symbolism, and social movements (Castells), shifted the focus of design to the non-visual space (Lefebvre). In MoMA's strategy, this establishment posing as utopia assimilated objections, although it succeeded in changing the notion of domesticity, or, in Emilio Ambasz's [9] words, establishing a new "domestic landscape."

The idea of "landscape" applied to design refers to the context of existence, to the scenographic environment of Stanley Kubrick's *2001: A Space Odyssey* and all utopias and its own technological poetics, with its program and radical exaggeration [10]—of which, even in the apparent technical reduction of culture, design would be a privileged instrument.

3   Future

In "The Future of the Humanity" [11], Kaku establishes a direct correspondence between transhumanism and technology, whether through the use of cybernetics and its devices, or through the enhancement of humans from genetic and bio-medical alterations that give them more and new powers, skills, and abilities. This topic is controversial, given its ethical implications. However, Dolly the sheep brought us closer to Pygmalion's dream. Given the ascendancy of devices and interfaces over experience, we live what Jünger [12] called a "total mobilization"—of bodies, of public and domestic space, of our time, of the field of perception, and even a certain sudden mobilization of the illusion of the world. In this planetary-scale awareness, design and its innovative purpose appear as keys to the future.

Since 2021, the London Design Biennale has sought to situate design in a time of crisis from some thematic axes, involving in each edition more than 500 designers from all over the world, with the aim of finding radical design solutions to deal with today's critical issues, from health to the environment, from society to work [13].

The changes in digital interfaces, visual and multimodal languages, but also the evolution of programming and coding, with the tightening of relationships between the fields of communication and interaction design, has brought to light inter and trans mediation strategies that place design at the center of new civilizational narratives [14]. These narratives are increasingly based on: information hierarchy; space-time non-linearity; longevity, the persistence in the present time; (un)predictability; hypertextual interactivity, moving from the interpretive to the appropriative dimension; and synchronicity, referring to the alignment between the time of narrative creation (design time) and the time of narrative reception (use time). In this dynamic framework, design assumes a change in its field of action and the new issues related to contemporary supports, platforms, processes, and methods of production and experimentation.

As a project, design is since its origin related to the idea of "changing life," embodying an emancipatory and even revolutionary power, which brings it closer to the vanguards that led to modernity, first by the industrial legacy that indelibly changed the material environment and the inhabited space, but above all by the

progressive expansion and dematerialization of its field, of which the cultural interference extends to the whole myriad of devices and interfaces that shape and condition the collective imagination, whether from models of interaction or critical references that amplify the issues of the new (trans)humanism and ecology.

In this framework, contemporary design struggles and opposes design itself. Radical design opposes the other design, seen as a physical device of hygienist bio-power, moving its field from the strict project practice to assume itself as a political, social, and even existential practice of liberation of man and culture, facing the ever more emerging environmental and public health issues, which force a permanent assessment of the place of existence. This is a process that can ultimately be devoid of objects, leading to disappearance, in which the only possible design is that of life itself.

Focused on the power of the collective imagination, design foreshadows utopia, materializes speculation, and gives critical shape to the future and to possible alternatives. In this sense, Formia [15] establishes a chronology and even an affiliation of the main issues that impact survival, in an exercise that seeks to understand how the future has been projected from the past and, on the other hand, centered in the Italian context, how "temporality" is present and conditions the culture of project. The perception of continuities and ruptures provides clues from which one can make this future archeology, greatly facilitated by the progressive dematerialization and by the centrality of the narrative processes themselves, with their own temporalities, rules, and discourses. Thus, just as museums were "spaces for time" the organizational structure, the classification of objects, and design activism are based on fluid and organic temporalities, progressively hybrid, in which the material domain and the digital spectrums continue and complement each other, making any categorization of "visions" more complex.

The computer is not the end of the gap between representation and reality [16], but design mitigates the distance between the physical and the intellectual world, establishing a balance between materiality and abstraction, absolutely necessary to establish new links, interconnections between creativity and the matter of the world, which we see as increasingly dependent on coding processes, which affect both static forms and the flows we want to generate and the energy they need.

4 Energy

The reflection around the relationship between energy and design will be susceptible to alter the course of history of design—this was achieved not only through pragmatic processes of production, representation, and meaning, but also from the impacts of creativity on geographical processes, bio-physical, climatic, and physiological processes, analogously to what García-German proposes [17] from energy, entropy, cycles, and pacts, an attitude that assumes deviating from classical mechanics and the hegemonic design culture, in favor of thermodynamics, ecology, and politics.

Precisely in 2014, Andrea Branzi, posed the question, in regard to the crisis of globalization, if design had not also become an issue of energy. A very complex one, but of the utmost relevance. It concerns mobility, the finiteness of the planet's resources, and even the dominance and risks of hegemonies and monocultures, including cultural ones, on a global scale.

The recent editorial by PAD—Pages on Arts and Design, entitled "The Value of Design in the Mediterranean" [18], underlines the contrast between Northern Europe, where industrialization was and is so deeply rooted, and the development model characteristic of the South, where the very discourse of transition moves away from the paradigm of the so-called Global North, centered on post-industrial ideas of degrowth, post-capitalism and post-humanism, while the South refocuses design according to the humanistic tradition.

In the same article, investigating the correlation between times of crisis, creativity, and new forms of cultural and social life, the growing relevance and impact of the crisis is highlighted "to determine unexpected cultural and social transformations," from two scenarios: the diaspora caused by the economic and financial crisis and the pandemic that shook the cultural and creative sectors, concluding from the case studies the potential of designers to adapt to difficult social circumstances, to become agents of knowledge transfer and strong catalysts of social innovation and co-creation.

Taking a step back from energy centrality, we can almost rewrite the history and theory of design, especially given the centrality of environmental aspects. McHarg [19] not only captured the zeitgeist of the 1960s, condemning modern civilization for environmental degradation, but proposed a practical method to react to it from a biocentric sense that harmonizes with the powerful forces and flows of the natural world. This premonitory character is more pressing today in the face of the unpredictable consequences of global warming, species extinction, and resource depletion, which reverse the perspective of the great progress registered from the eminent end of humanity. A process that entails great injustice, insofar as the great beneficiaries of this developmentalist paradigm are a tiny part of living beings and of humanity, which will also be affected in a very asymmetrical way.

5   Transition

Today, designers are asked to have that prospective sense, in line with the four dimensions of design for innovation as set forth by Stilgoe and Guston [20]: Anticipation, Reflexivity, Inclusion, and Responsiveness. These dimensions converge with the Great Transition Initiative's program [21], which makes a vehement appeal to the change in mentality, posture, and way of projecting in the so-called Anthropocene Epoch, as contentious as this expression may be.

Going over this controversy and the contradictions of this Epoch, Fuad-Luke [22], commissioner-general of the Porto Design Biennale'21, proposes an attitude of "Designing towards the Sympoiecene", considering human diversity, visible in

language and culture, but also the non-human biological diversity, seeing this time as an event of traumatic extinction because of the massive depletion of resources imposed by the capitalist model. Beyond this aspect, to some extent Arcadian, Fuad-Luke puts the emphasis of design on the relationship and on sharing, whether on a social, environmental, multi-species or co-creation level, advocating a non-extractive sense of community empowerment for Design, one that opens the field to the urgency of counter-hegemonic heterodoxy and restores, as beautifully put by Maldonado [23], a projectual hope.

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Mediated Authorships: The Designer as the Instructor of Machines

Luis Ortega and **Julia Capomaggi**

Abstract The implementation and use of artificial intelligence (AI), and automatic learning in particular, are ushering in a methodological and conceptual updating of creative practices and their associated theory. The roots of these changes lie in disciplinary traditions associated with research into automatism promoted in the 1960s, with the introduction of cybernetics and computational sciences. This article focuses on the spread of the notion of authorship in architecture in the digitalization process and takes the discussion of systematic automatism in home design as a case study. For doing so it revises the main theoretical references, particularly the work by Gordon Pask, unfolds projects from the 60 s to post the main questions raised by AI today in the Design Field in respect to Authorship. While Gordon Pask suggested the transformation of the architect into a systems designer, now we can state that this is an environment in which the architect is transformed into an educator and a critic, an educator in the sense that they have to design the datasets, or conditions of possibility of learning; they have to instruct the generative and discriminative neural networks through numerous groups of "examples" and guide this learning through weighted assessment protocols.

Keywords Machine learning · Authorship · Domestic space

1 Automatism and Mediated Authorship

One of the most heated controversies stemming from the introduction of digital technology into architecture is the hypothetical dissolution or diminishment of the role of authorship in the new and highly automated processes. This debate has become even more heated with the implementation and use of AI in design processes.

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Three positions can be made out within this controversy [1] The first would claim that there is no change from the modern mechanical model: the computer is viewed as a mere instrument that conditions some factors that affect the course of projects—design speed, management of a vast amount of information, etc.—yet does not substantially change the practice. The second claims that computers will make the former figure of the architect vanish to instead be replaced by a new figure within a model where the medium affects the design process to such an extent that it even casts doubt on its authorship.

However, this text is based on a third view, in which the architect who operates within digital logic is no longer doing so as an alternative that is incompatible with the model of the modern architect who worked from the mechanical perspective but from an expansive turn in their abilities and conceptual frameworks. In the case at hand, the impact of the use of automatic learning processes in home design in Italy in the 1960s, for example, can be aligned with traditions and sensibilities from outside the discipline in the mechanical era, with periods in which the design of automatisms— such as clocks and the first automata—focused the discussion and efforts of scientific and artistic communities equally. Arguments associated with mechanically mediated creativity and the emergence of order from autonomous machines were bandied in these debates, and an imaginary and terminology were developed that conditioned both mechanized and more artisanal creative practices. The questions that have arisen in recent years on the ability to establish autonomous processes of design, projects, data management, and creativity in general through the use of algorithms is a deeply rooted line of research, yet until now they have never been considered as urgently or with a tone that is so threatening to many designers. In almost all cases, this anxiety is spurred by the lack of appropriate categories and resources to harness the opportunities and new modalities of projects brought about by automatic learning processes.

2 The Emergence of the Systematic: Computation, Cybernetics, the Architect as a Systematizer

The epistemological turn introduced by computation can only be understood if it is tackled from a perspective that goes beyond the merely instrumental. The theoretician Gordon Pask claimed that the true impact of cybernetics in architecture was metatheoretical. Just like the linguistic turn in philosophy, which shifted the focus of study, the digital philosophical turn shaped a new language to address and develop the discipline. In his article "The Architectural Relevance of Cybernetics,"[2] Gordon Pask outlined cybernetics' potential in architecture by upholding the effects of architecture not only as an instrumental phenomenon but also as a new theoretical framework for thinking about and designing cybernetics. The new architect is presented as a designer of systems with interests honing in on the organizational properties of the systems of development, communication and control. Pask viewed cybernetics as a

metalanguage that enabled the role of the new architect to be addressed critically. Computers' ability to act as mediators between the designer and the design turned the former into the controller of controls, a catalyst, a meta-systematizer. The positivistic ingenuousness of early cybernetics and its ensuing architectural proposals reduced computational power to an instrumental problem of optimization. They somehow reflected the model of paradigm shift that aspired to resolve anomalies thanks to the power provided by digital technology and the new science that came with it. However, Pask's vision was much subtler and more powerful in the middle and long term. Indeed, when Pask stressed the role of cybernetics as a metalanguage, he was nonetheless calling for a linguistic revision of architecture to establish it as theory.

This new theory reflects the figure of a new author. Two episodes are usually recognized as the most significant in the inception of the notion of author of architecture: first, the construction of the dome in Santa Maria dei Fiore cathedral in Florence by Filippo Brunelleschi, and secondly the theory outlined by Leon Battista Alberti—which he set forth in the first, second and ninth books of *De re aedificatoria*—on the identification of the project as the priority goal of the architect's output and its distinction from the built work, the latter a reproduction of the model defined by document-based representation [3].

Brunelleschi represents the autographic model, in which the built work is a direct result of the author, while Alberti believes that the true designed object is the project, while the built object is merely its copy. This distinction has important implications. The first of them is purely disciplinary. While in Brunelleschi's model the author is constituted by authority, holding the information and transmitting it directly or via scale models that represent the object to be built, in Alberti's model there is a mediator between the author and the built work: systems of representation. Alberti believes that the drawing as a document representing the object is the true work of the architect, because other people actually build it.

Conversely, Brunelleschi needed to be at the construction site to guarantee that the building was constructed following his instructions and that he was recognized as its author, which included carefully meting out the information in each stage in order to avoid being excluded from the process. In an era when the author was not a recognized figure, oversight of construction entailed an entire series of operations directly targeted at ensuring the author's control and recognition, and this necessarily entailed managing the information. On the other hand, Alberti poured all his efforts into the notational and representational system in order to guarantee that the documentation that reached the construction site enabled the project to be faithfully reproduced the way the author had envisioned it. All of Alberti's effort and ingenuity were funneled into accurately representing his project so that it could be reproduced in an era when the printing press did not yet exist. Aware of the shortcomings entailed in reproducing an image faithfully with a hand-drawn reproduction, Alberti's inventions were aimed at alphanumerically coding the images.

The effort to describe or alphanumerically codify in pre-typographic culture was immediately surpassed by the visual culture that Sebastiano Serlio set forth in his treatise with the graphic reproduction of the orders. Typographic architecture reached its

apogee with the advent of the printing press thanks to a new technology that concentrated all the narrative power of the old theory in the transmission of images for the first time. The effort to achieve descriptive precision which stimulated Alberti's experiments to guarantee a faithful reproduction of the original was suddenly interrupted with the advent of a much more appropriate and effective technology: typographic reproduction.

Each of the different technological stages has different conceptual frameworks and definitions of authorship. In the crafts, works are recognized by similarity. The craftsman may produce similar works, but the author operates with a recognition pattern that is not based on his output being identical. Authorship in pre-mechanical culture has nothing to do with the idea of identity but instead with similarity. A craftsman was recognized as an author because he produced similar or comparable—though not identical—works. This recognition of authorship was more diffuse than what developed in the mechanical age. The notion of similarity is more complex than identicalness in that the variations may be important and yet the objects are still recognized as belonging to the same author.

This entire conceptual framework shifted radically in the age of technical reproduction. The parameters that governed the framework of visual culture during the typographic era were identicalness and copy. An author was recognized as the author of the original, yet also as the "intellectual author" of the copies that were mechanically reproduced. In many cases, a design was associated with the representation that allowed it to be both produced and mechanically reproduced. Given the logics and restrictions of production, all mechanically produced objects are identical, thus signaling a shift from an artisan culture which recognized authorship via soft parameters like similarity to a culture which refers to identicalness.

However, with the introduction of the digital media, the idea of variability and series has been revived, even though they are closer to the culture prior to the printing press than to the Western typographic culture. Studies like the book on the figure of the craftsman by Richard Sennett hold up this figure associated with effort and detached from technique or technology [4]. From this standpoint, a carpenter, a surgeon, or a computer programmer would be a craftsman based on the mere fact of being associated with work as an end in itself and focusing their efforts on material perfection through stringent control of the techniques needed to do so. Sennett has even quantified this effort: 10,000 h of practice are needed to achieve sufficient skill. Therefore, from the standpoint of production, the artisan era stands out for variability, which is, in turn, limited by the craftsman's capacity, while mechanical serial production is limited by repetition. In turn, digital production revives variability yet without quantitative limitations. The latter may have enormous potential depending on how you look at it yet also poses a major challenge for our visual culture. From an order of values built upon limited references—limited similarity in the case of the craftsman or repetition in mechanical production—it is difficult to address the comprehension and legibility of such an open framework that ultimately requires a redefinition of the conceptual and aesthetic categories with which we operate, a reformulation that also directly affects the traditional modern conception of authorship on which the disciplinary ontology is grounded.

Another of the usual assertions about digitalization is that the computer is a technical mediator between the designer and the designed object: the software used conditions the project and facilitates or promotes a certain type of geometries and shapes. Although this observation is accurate, it does denote an excessively instrumental approach to computation. The impact of this logic is unquestionably important, but digitalization has much more important effects that require a different type of analysis. The use of the computer introduces variability and non-standard seriation as a new frame of work, a change that fundamentally distinguishes the digital age from the mechanical age (and its associated repetition-based culture based).

The difference between design and production on which mechanical culture was based dissolves in the digital age. Thus, there is a shift from a model of author based on control of the representation, with the project as the designer's main object, to a model in which the author(s) require not representation but modelling to build. On the other hand, parametric systems mean that the designer is more a designer of algorithms than objects. There is a move from the model of the designer who is the author of objects to the designer who is the author of *objectiles*.

3 Domesticity in Italy in the 1960s as a Setting Where Antagonistic Logics Unfolded: Two Cases of Programming

In the 1960s, the domestic space turned into a field of experimentation where seriation, automatic mechanisms, and prefabricated elements had to grapple with the sphere of individual expression and manifestation and consequently had a greater need for variation. Some proposals tackle the problem by reproducing the organizational structure at smaller scales, while others do so by amplifying certain objects' capacity until turning them into automated pieces where the individual space is concentrated in the space between mechanical artefacts and architecture, often generic containers with low architectural quality. Other works focus on new methodologies. This scenario became the forerunner of some of the challenges posed today by the use of machine learning in residential architectural projects.

In his essay, "Whatever Happened to Total Design?" [5] Mark Wigley claims that projects with more flexible ambitions seek an inflexible aesthetic agenda. Total design, design totally controlled by the architect where the user's degree of freedom is limited to superficial alterations, often contrasts with models whose goal is the quest for flexibility.

Even though rigid structures can absorb variation, multiplicity, and heterogeneity with the goal of developing uniqueness, experiments like the one led by Enzo Mari and Bruno Morassuti, entitled "Arte programmata e prefabbricazzione," [6] are based on integrating unmeasurable individual needs and organizational spatial structures in a programming system which becomes a design methodology.

The proposal is presented via a table, which is also the elevation of the proposal. The table-elevation "indicates a sequence of the displacement of each cell in depth. The sequence is regular, ascending, and descending: 1, 2, 3, 4, 5, 6, 5, 4, 3, 2, 1, 2, 3, 4, 5, 6, 5. The sequence begins with three rows, and with continuous movement it tends to occupy all the available space according to a square spiral movement. After three rows, an internal row, a middle row, and an outside row emerge with respect to the center of the spiral, such that in its development a dissonance is created that tends to shift in each turn. In fact, the sides of the spiral are reduced on the outside and vary in relation to the length of the side and the length of the numerical scale. Finally, the composition, the tendency of the spiral, remains as a scheme-guide of a sequence of thematic variations in all directions (such as: 2, 2, 3, 4, 2, 1, 2, 4, 56, 4, 5, 3, 4, 5, 1, etc.)" [7].

Mari's project is based on the quest for utility introduced in prefabrication in urban planning, architecture, and furniture, via "visual programming," a topic that Mari had been developing since 1954 via thematic variation, the treatment of color, volume, kinetics, and prefabrication.

The "analogical software" is an experiment to measure the potentiality of this type of process. Mari and Morassuti warned that the danger of prefabrication and programming is that they detract value from the architect's expressive possibilities, and in order to counter this they sought a design model that would become an instrument capable of overcoming the arbitrariness of the unique for those aspects the go beyond the purely technical. The structure of the organism's internal demands and the choice of the type of visual programming had been integrated since the original schemes. The programming was based on a modular, numerical sequence in which "large zones can be structured: from urban dimensions to a home interior" [7]. The structure can be changed and arranged according to physical variables (orientation, noise, wind, etc.) and psychological variables (color, shape, etc.), while the interpretation of the numerical sequence would be mutating and unstable to the displacement of the spectator and the movement of the shade during the daytime hours. Six types of cells are proposed, some of them with a double façade and others with a single one, along with five types of residential cells of differing sizes, which are unified in a module of variation of 1.20 m, the minimum, indivisible size of the inhabitable module in the proposal. Mari and Morassutti's method emerged from the gestation of a theorem comprised of systems, the incorporation of intangible data, and their translation into rituals capable of informing industry and incorporating creativity into mass manufacturing.

Another study in a similar vein was conducted by Claudio Salocchi as part of the exhibition *Eurodomus 4* (1972) [8]. Salocchi conducted a study in which he used the house as a field to measure the functional and psychological needs that are common to all users; he then assigned them different values, where zero means a minimal solution. His proposal sought to reinvent the room, and he believed that in order to change the conditions it was essential to rethink the underlying structure.

Salocchi presents a double-entry table which weighs variables like kitsch, globalization, new family, colonization of the space, sleep, symbol, city, politics, distinct space, space of integration, space of rehabilitation and hygiene, space of movement,

functional-work-study space, functional-free time space, modulation, flexibility, centralization, functionality, self-structuring, valance, evasion, decoding, sensibility, simultaneity, paper, and associative process with values of 0 and 1, and he claimed to have created a useful means to measure the role of individuality in the domestic space.

The final proposal consisted in a standard-sized module (12.90 × 9 × 2.40 m) with a grid that extends onto its walls and floors, where the room begins to be colonized with circulation, communication, hygiene, and eating. The photographs showed some environments in which each room was independently defined from the other spaces. The house became a set of "à la carte" rooms.

4   Machine Learning: The Authorial Expansion Towards a Digital Muse

Research into the use of automated learning in architectural design has accelerated in recent years. Processes based on unsupervised learning via databases and the use of neural networks seek to replicate human behavior in different spheres. But what happens when what we are trying to replicate are creative processes such as those involved in home design? What is the role of the new architect? Is creativity possible? If it is possible, what does it consist of?

While authors designed objects in the predigital era and systems in the early digital era, now we are confronting a hybrid process in which the computer autonomously processes much of the generative project. The challenge of these situations is that in many AI environments, the procedures are designed for optimization, while in an architectural project, as Mari and Morassuti noted, antagonistic and often irreconcilable logics are superimposed upon each other.

The use of GAN (Generative Adversarial Network) [9] has emerged as an interesting platform for experimenting in this field. Generative and discriminative neural networks establish a zero-sum game in which the process learns autonomously. Somehow the computer not only generates but also critiques. Without entering into the technical details of this type of procedure, we can say that it is an environment in which the machine is a highly powerful generative prosthetic. Without a doubt, the challenge shifts to the discussion of the quality of what is generated and authorship procedures in such technologically mediated environments.

While Gordon Pask suggested the transformation of the architect into a systems designer, now we can state that this is an environment in which the architect is transformed into an educator and a critic, an educator in the sense that they have to design the datasets, or conditions of possibility of learning; they have to instruct the generative and discriminative neural networks through numerous groups of "examples" and guide this learning through weighted assessment protocols.

While in the 1960s, we witnessed similar protocols that sought to systematically integrate quantifiable objective procedures with processes of qualitative intangible

assessment, today this same challenge is arising once again with the implementation of computerized autonomous learning.

On the other hand, at the other end of the process the architect in the AI age has to be a critic who is competently able to read what the machine has produced and based on that build the feedback procedures on instructional processes. This is a loop with three stages: instruction based on datasets designed to build a learning field, automated generation based on generative and discriminative networks, and evaluation procedures that enable the initial instructions to be reconsidered. The architect as teacher and critic captures opportunities on the fly in an environment of accelerated automated production, where the machine produces and learns. Production, originality, and creativity are funneled in processes of learning and deviation from architectural primitives which were generated by learning from creative networks and their interaction with discriminative networks.

The dynamic established in this creative process also has an effect on the architect. In order to instruct the networks and effectively critique what it generates, everything has to be done systematically. The categories, procedures, techniques, and languages developed since the implementation of cybernetics come to the aid of the expanded author, giving them a conceptual framework in which they are able to communicate with autonomous processes in a casual, cultural way without surrendering to the optimizing system. The computer is not an instrument but instead becomes a digital muse.

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