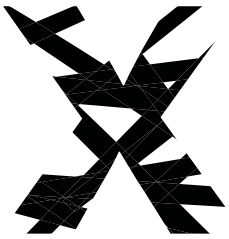

UXUC

Interaction Design, **User Experience & Urban Creativity Scientific Journal**

Research through Interaction Design (RtD + IxD = RtIxD)
Vol. 3 / Nº 1

Urbancreativity.org

Title:
User Experience & Urban Creativity
Scientific Journal

Editors:
Sonia Rafael
Marco Neves
Pedro Soares Neves

Contact and information:
info@urbancreativity.org
Urbancreativity.org

ISSN (print) - 2184-6189
ISSN (online) - 2184-8149

Editorial

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RtIxD and the willingness to discover, act and contribute

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The Special Issue *'Research through Interaction Design (RtD + IxD = RtIxD)'* emerged from our desire, as interaction design teachers, to value design as a creative, practice-led project activity, based on holistic methodology that contemplates various sides of interactive experiences. Also, as researchers, to position design methods as a noteworthy way to achieve more knowledge in an area still defining itself.

In our understanding, this vision is particularly important for teaching and researching in interaction design, as it allows us to guide future researchers towards thinking about and with design projects, its complexities, uncertainties, riches and advantages. We appreciate the meaning of a design project in an ambivalent perspective, both in anticipation of what does not yet exist, and in the manifestation of what is potentially already there. In this 'in between' we find a privileged space for discovery, as resulting from a mismatch between chance (identity) and necessity (society).

In this context, a design project should not be understood as an unalterable and regulated procedure, but as 'anything' open to mediation, and each choice combines with all the others to unravel the improbable. If the ambiguity of a design project's core is to be removed, the meaning of design will be lost.

Design practice, which in some circles can be assumed as exaggeratedly subjective, dependent on the designer's creative control, has, in interaction design, been flooded by an objectivity, technicality and rationality, which deprives it of some of its purpose. Suppressing a creative practice due to tasks that are merely fulfilling obligations, translates into little gain for the advancement of that practice. It prevents acquaintance and recognition of its process, of the procedures that help to understand proposals and the reflection of those who practice it.

On the other hand, research has been covered by its own analytical and measurable certainty, which has given rise to prejudice to assert other ways of doing it. This apparent departure has made it difficult to realize and, even more, to set in motion, simultaneously, a presence of research in interaction design and a presence of interaction design in research. Although interaction design, given its origins, very close to computer sciences and behavioral sciences, is from all areas of design, perhaps the most conducive to such a relationship.

We often hear about the need to make design research more scientific. For this to happen, appropriate methodologies and procedures are needed in design research, but that does not detract from design creativity.

In recent years, particularly from the perspective of Frayling (1993), operative terms 'research' and 'design' have come together and converged in a methodology that recognizes the design process as a legitimate research activity – Research through Design (RtD). This way to perform research is constituted, in Burdick's perspective, by the design process itself, including materials research, development work, and the critical act of recording and communicating the steps, experiments, and iterations of design (2003).

Several authors (Stappers & Giaccardi, 2002; Frens, 2007; Zimmerman & Forlizzi, 2014; Durrant et al, 2017) somehow claim that knowledge can be learned more effectively through practice, i.e., from the active experience and consequent critical reflection of that experience – for instance, through a design project. In this way, by articulation of practice with theoretical research, we generate a dynamic and iterative relationship – we question through design projects and act through theory, and vice versa.

'Research through Design' was initially applied in the context of Art and Design and gained notoriety in several fields, including Human-Computer Interaction (HCI) and Interaction Design (IxD). As an approach to interaction design, RtD integrates models and theories with technical knowledge in the design process (Zimmerman et al, 2007). This made it possible to generate expanded knowledge through creative, speculative and experimental viewpoints that help designers deal with complexity. Still, we found that, although RtD's relationship with interaction design have mainly fallen within the scope of HCI, there have not been consistent studies with a broad view of interaction in its connection with design as project activity.

This observation led us to propose, as theme of this issue, the association of Research through Design with Interaction Design (RtD + IxD = RtIxD) to provide a space for reflection on design praxis as an acting involvement in generating knowledge for the area. Therefore, an attempt was made for that space to foster interdisciplinary debate and to strengthen an RtIxD methodology, to understand its application in different contexts, to assess obtained results and its impact on research, education and/or design activity. It was also aimed at attesting its potential for developing creative interactive systems that include a critical and speculative dimension.

The articles now published reinforce this suitable connection that can be established in interaction design. Due to processes with similarities, where a sequential structure is based, filled by methods with specific attributions and that contribute to design project's development, interaction design lends itself to an association with research.

We can verify that various authors resorted to practice-based methods in or related to interaction design: user research, personas, user scenarios, customer journey maps, storyboards, wireframes, user testing, user interface and prototyping. Not only are they used as procedures that raise, analyze and process information, which influence designer's options; but also, originate research paths for interaction design.

A broad scope for the practice of interaction design is pursued in several articles, which ranges from paper as physical existence to information immaterial condition. It can also be observed in a reverse way, from an intense digitization and automation of systems that confront and question human beings, to tangible media that privilege the senses and expand our possibilities of action as interaction designers, turned researchers, using our practice to increase available knowledge.

One of the concerns when preparing the call for this issue, which is also evident in the articles now published, is the understanding of what the area of interaction design is nowadays. How is it described and defined, what are its borders, what future paths and how to contribute to them? Höök and Löwgren (2001) give us interesting clues in their synthesis of the area, confirming a physical/digital existence, where the designers' ability for anticipation meets tangibility, where computing and haptic come together without seeming to be a mistake. Understanding interaction design in this way will satisfy designers, those who may have found interaction design, in a path unrelated to HCI and as such, without wanting to obey a technological imposition or without possibilities beyond devices. Not that HCI has not understood the same and has adapted to a ubiquity that no longer sees the computer as a machine, but rather as a constant, continuous and dispersed presence (Rogers 2009). But given this potential, designers find an open field for their research, incorporating methods they know best and deal with the most, those of a practical and qualitative nature.

We have found it clear, the importance of having a creative and reflective process for interaction design, connected or not with material output and beyond measurability. More than testing and evaluating projects in their distinct manifestations – something for human factors to explore and for feasible implementations – it seems necessary to reinforce interaction in the intersection of art, science and technology. Using RtIxD, design researchers must direct their gaze to the future in a continuous anticipation movement that will allow them, not only to find solutions to commercial-based problems, but to exercise the right to have an active and world-wide voice over reality. Published articles relate design projects that are essentially original in their conception and in their approach to contemporary concerns, where interaction design achieves cultural, political, ethical and social function, always directed towards interactive experiences.

References

Burdick, A. (2003). Design (As) Research. In Brenda Laurel (ed), *Design Research: Methods and Perspectives*, p.82. MA: MIT Press.

Durrant, A. C.; Vines, J.; Wallace, J. & Yee, J. (2017). Research Through Design: Twenty-First Century Makers and Materialities. *Design Issues*: 33(3). MA: MIT Press.

Frens, J. (2007). Research through Design: a Camera Case Study. In Ralf Michel (ed). *Design Research Now. Essays and Selected Projects*, pp.135-156. Basel: Birkhäuser.

Frayling, C. (1993). *Research in Art and Design*. Royal College of Art Research Papers Volume 1, Number 1, pp. 1-5. UK: Royal College of Art.

Höök, K., & Löwgren, J. (2021). Characterizing Interaction Design by Its Ideals: A Discipline in Transition. *She Ji: The Journal of Design, Economics, and Innovation*, *7*(1), 24-40.

Rogers, Yvonne (2009). The changing face of human-computer interaction in the age of ubiquitous computing. In: Holzinger, Andreas and Miesenberger, Klaus eds. HCI and Usability for e-Inclusion. Lecture Notes in Computer Science, 5889. Berlin: Springer, pp. 1–19.

Stappers, P.J. & Giaccardi, E. (2002). Research through Design. In: *The Encyclopedia of Human-Computer Interaction*, 2nd. Ed. Chapter 43. Interaction Design Foundation.

Zimmerman, J. & Forlizzi, J. (2014). Research through design in HCI. In Olson, J. & Kellogg, W., eds., *Ways of Knowing in HCI*, Springer

Zimmerman, J.; Forlizzi, J. & Evenson, S. (2007). Research through design as a method for interaction design research in HCI. *CHI '07: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, April 2007, pp. 493–502.

Soundscapes:
A hybrid (sound) book for anxiety

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Abstract
Emerged in later 2019, the COVID-19 pandemic caused several impacts on the economy, society, and lifestyle. Because of a context of fear, unpredictability, and compulsory social isolation, mental health diseases such as anxiety and depression have increased greatly all over the world.

The lockdown enforced the use of online technologies for work, education, entertainment, and socializing. However, some studies already show that excessive screen time often leads to states of anxiety and addiction.

The purpose of this study is to evaluate the relaxation effects from the use of a hybrid sound book that uses printed electronics to allow the reproduction of nature's sounds. Additionally, a set of gestures was established in order to investigate if they would be considered intuitive or not.

The design process was divided into three phases: exploratory research, for gathering information about the topic; ideation, defined by the experimentation of ideas and concepts and prototyping, whose objective was to establish affordances and types of interactions; and testing, which target the evaluation of usability and user experience.

The final prototype was tested by six participants. Although only a few participants demonstrated comprehension of the affordances proposed, mostly considered to have high levels of pleasure and excitement while using it. These findings indicate that the prototype "Soundscapes" can act as an alternative for entertainment and stress relief at home by manipulating a physical paper while exploring touch and pressure in the object itself.

Keywords
Mental health, Hybrid Books, Printed Electronics, Interaction Design, Tangible Interaction

1. Introduction

COVID-19 was first identified in December 2019 in the city of Wuhan, China. Later in January 2020, the World Health Organization (WHO, 2020) declared a state of a public health emergency, and it was also around this time that the WHO warned that this crisis was generating anxiety and stress in the population.

Quarantine was imposed by governments as a measure to prevent, contain and spread the virus (Brooks et al., 2020). There were a few studies (Bai et al., 2004; Wu et al., 2009;

Wang et al., 2011; Liu et al., 2012; Sprang & Silman, 2013) regarding those who stayed in quarantine versus those who did not, where the results were concise with each other. A large proportion of individuals who were quarantined reported anxiety symptoms (DiGiovanni et al., 2004), which in the long term are shown to be quite damaging and long-lasting (Brooks et al., 2020).

Anxiety refers to the brain's response to danger, a stimulus that the body actively tries to avoid. This brain response is a basic emotion, present in childhood and growing up, with expressions ranging from mild to severe (Beesdo et al., 2009). Naylor et al. (2012) shows that people who suffer from mental health problems are more likely to experience physical health problems such as diabetes and coronary heart disease, have a shorter average life expectancy than others, and are more likely to use alcohol or drugs.

The major factors reported for increased anxiety during the quarantine were based on the duration of quarantine, fear of infection, frustration, boredom, concern about supplies and food and not getting adequate information about this disease. After quarantine, it is observed that finances and stigma are the main factors for increased anxiety. To mitigate these effects it is suggested: shorten the days of quarantine, give necessary information to people, provide adequate supplies, reduce boredom and improve communication and pay special attention to health professionals (Brooks et al., 2020).

As people remain physically distant during quarantines and spend more time at home, the use of the internet, cell phones, and other electronic devices increased (Unep, 2021). However, this excessive consumption of technology can affect an individual's physical and mental health (Caplan, 2007; World Health Organization, 2014; Li et al., 2021). Addiction to cell phones and others can cause sleep problems (Sahın et al., 2013) but also increase anxiety and depression. This type of addiction can be associated with loneliness, leading to boredom proneness and consequently reducing an individual's self-control mostly in adolescents and young adults (Shen & Wang, 2019; Li et al., 2021). With this, and to mitigate these types of addiction problems and help to cope with anxiety and depression, it has been identified as an opportunity to create an entertainment and self-care moment away from smartphones and computer screens based on tangible objects that motivate physical manipulation and stimulation of senses other than sight. Thus, it was thought to create a hybrid book that activates sounds of nature in its physical manipulation, to explore the potential of this object as entertainment that improves health and mental well-being.

The hybrid book is the symbiosis between a print and a digital book (Rosária, 2019). In its physical form, it resembles a printed book but contains a digital layer, so interactivity can be integrated into this object by inserting video, sound, or animations through augmented reality (Schmalstieg & Hollerer, 2016) or even through printed electronics, such as using conductive ink.

Multimodal stimulation can be used to enhance relaxation experiences and improve well-being (Nijholt et al., 2010). Paper is a tangible object that is immediately receptive to the execution of actions and has some advantages, characteristics, and affordances that other graphical interfaces don't have and that can be used as a provider of tactile feedback that can increase a state of calmness in individuals. However, it also has the advantage of being thin, light, flexible, porous, and it can also have different levels of roughness. In addition, it has different types of physical affordances depending on the functionality and context of use (Sellen & Harper, 2003).

There are many complementary interventions used alongside pharmacological and nonpharmacological treatments regarding anxiety, as the use of multisensory stimulation (MSS) (Moghaddasifar, et al., 2019). MSS is very much used as a method of rehabilitation treatment in older adults and patients with dementia or Alzheimer's (Ozdemir & Akdemir, 2009; Vazini Taher, et al., 2015) because it stimulates the reticular activating system promoting brain healing which consequently reduces the risk of sensory deprivation and facilitates the improvement of various responses in patients (Moghaddasifar, et al., 2014).

However, since the MSS method uses visual, auditory, tactile, olfactory, or gustatory stimulations it can also be useful for treating anxiety in people of all ages and be a mood regulator (Canbeyli, 2010). Those stimulations can be provided by using lights, music or sounds, palpable objects, and even taste (Staal, et al., 2007).

Regarding the sounds, some are proven to induce and help to achieve a relaxed state, which we were looking for in this project. Natural sounds are perceived as pleasant while the typical technological sounds of urban environments are perceived as unpleasant (Brown & Muhar, 2004; Nilsson, & Berglund, 2006). Several studies have shown, using visual and sound stimuli, that natural environments have a positive effect over urban environments, the positive outcomes include the increase of well-being by inducing positive emotional states and therefore decrease physiological stress responses (Ulrich, 1984; Van den Berg, et al., 2007; Grinde & Patil, 2009).

In this project we present "Soundscapes", a hybrid book that uses the haptic properties of the paper, bringing the richness of this component as a physical device combined with nature sounds to help reduce stress and anxiety at home. This study aims to explore the user interaction with digital content by using auditory and tactile stimulation as the main senses.

2. Design Process: How interaction design helps mental health during COVID-19's restrictions

The development of this project consisted of three phases: the application of a questionnaire and semi-structured interviews about mental health and social isolation, and an exploration of benchmarking focused on different forms of interactive printed books; sketching and prototyping; and testing.

2.1. First Phase: Understanding user context

To confirm the insights from the literature review about the mental health impacts of COVID-19 and to identify which group of participants would be most affected, a questionnaire was created, followed by a semi-structured interview. Thereafter was made a benchmarking exploration-based of interactive printed books. The result of these methods generated a target group, represented by a persona.

2.1.1. Understanding user's behaviors in COVID-19 confinement

A questionnaire was created to identify which group of people would be more susceptible to presenting symptoms of emotional fragility in the pandemic context. It was expected that the results of this method confirmed the data obtained from news and articles. The questionnaire was developed in Google Forms, shared on online platforms, and had the participation of 40 people. It consisted of multiple-choice questions about mental health and the questions were presented on a Likert Scale from 1 to 5. The main goal of this method was to understand the thoughts and behaviors of the participants while at home in the context of social isolation. In the end, it was also presented general questions about the demographic profile of the participants.

The results identified that women from 21 to 29 years old (43%), expressed a higher level of emotional stress. Most of them reported being lonely (88%), even those who declared living together with relatives or a partner. The aspects that these participants considered that affect their mental health the most were dissatisfaction with themselves (43%), the effects of the pandemic (27%), and social networks and technology (16%).

Given the context of social isolation, the participants maintained their mental well-being at home by practicing physical exercises (31%), avoiding social networks (27%), and watching movies and series (21%). Regarding mindfulness practices, most of them reported having practiced meditation or at least have already tried it (86%).

Female participants from 21 to 29 years old reported greater loneliness, stress, and dissatisfaction, emotional states that may or may not be related to social isolation at home due to COVID-19. However, as recent studies have shown, prolonged social isolation alone may worsen such symp-

toms.

These findings suggest that people feel stress and anxiety by the confinement at home imposed by COVID-19 restrictions. They tend to use media as entertainment as a way to relieve them. However, it may support the hypothesis that the screen time of electronic devices and excessive use of social networks and technologies can lead to some level of exhaustion and negatively affects mental health.

2.1.2. How the COVID-19 restrictions affected women

Since female participants reported greater levels of emotional fatigue according to the questionnaire results, a semi-structured interview was conducted online with 5 participants between 21 and 19 years old. The objective of this interview was to understand the behavior of these women to relieve the stress of confinement at home. The questions were designed to gather opinions about mental health, to find out how the pandemic restrictions changed their mental well-being routine, and how technology and electronic devices motivated, positively or negatively, changes in their humor.

Regarding the opinions on mental health, the interviewees attributed mental well-being as a result of routine and management of feelings. The increase in the usage of smartphones and social media while at home, driven by the need for social connection and distraction from confinement was reported by most of them.

Moreover, they were able to identify the decrease in their mental health well-being motivated by the higher usage of screen time and reported increased anxiety in anticipation of notifications and messages. Two interviewees revealed that they physically isolate their phones in another room to focus on other tasks.

The results of the semi-structured interview emphasized the importance of mental health and also a significant correlation between the excessive usage of smartphones, computers, and social media and the increase of negative feelings. Next, a persona was created, with a brief description, lifestyle, goals, frustrations, and needs to contribute to the ideation phase and to represent this target group.

2.1.3. Reducing anxiety by reducing the use of electronic devices

What emerged from the results was a correlation between prolonged home confinement and mental health decline because of the excessive use of electronic devices and the extended online content they offer. Therefore, although the main purpose is to distract and entertain it can provoke anxiety.

That suggests a form of entertainment out of the dispersive online environment represented by smartphones, computers, among others, that contributes to reducing anxiety at home. In this sense, a form of autonomous hybrid interaction, that offers the benefits of the physical touch, and the surprise component offered by the digital content, seemed an alternative with the potential to be developed.

Looking back at traditional media, the exploration of a book as an interface started in this ideation phase. The further experimentations aimed for creating a way of entertainment for mental health purposes, through multisensory stimuli and the application of developing technologies.

2.1.4. Benchmarking

The focus of this phase was to find projects that were related to books in different levels and depths of interaction, from physical to digital.

“Sensory Fiction” (Heibeck et al., 2014) composed of a vest and an interactive book, is an exploration in augmenting emotions in readers by using a wearable system that stimulates physiological responses while interacting with the story. The relevance of this project is based on the possibilities of interacting with the content of a story by using emerging technologies that can associate body and physical sensations.

“Blink” (Kelaidis, 2017) and “Elektrobiblioteka” (Wegrzyn, 2012), integrates digital content into physical books via circuits printed in conductive ink. These projects generate a hybrid book with the look and feel like a traditional version while offering a non-intrusive multi-sensory reading experience. While in “Blink” (Kelaidis, 2017) new content

composed of text, images, and/or animation is shown on the screen of a computer with a click of a button printed on a page, in "Elektrobiblioteka" (Wegrzyn, 2012) digital content is shown when the pages are turned. What is remarkable about these hybrid books is the idea of a paper-based product with digital capabilities based on printed electronics.

"T-book" (Technische Universität Chemnitz, 2021) is a photo book with speaking images. When the pages are turned, the sensors activate sounds. The relevance of this technology is represented by further developments of novel concepts for sensors that are lightweight and flexible, providing another layer of experience with papers and books.

Regarding the physical aspects of the paper, "This book is a planetarium" (Anderson, 2017) is a pop-up book that allows readers to build and use gadgets made by paper folds. Each turn of a page reveals a different paper structure that forms a small projected planetarium, a musical instrument, a sound amplifier, and others, offering a unique object made of paper that invites interaction and physical manipulation. This demonstrates that there is already enough technology available to develop a paper interface with digital components and beyond that. In addition, using printed electronics makes it possible to preserve and explore its physical characteristics, from touch to texture, while accessing another layer of the reading experience with senses.

2.4. Second Phase: Paper experiments

A couple of sketches and paper experiments were made until a low-fi concept could be considered as a working basis. Second, an exploration of areas of touch, functionalities, and tasks was defined.

Followed by the discoverings of the previous examples, four concepts were developed on this exercise (Figure 1). They had a common purpose of generating ideas of books and paper folds, shapes, and forms of activating sounds by using printed electronics and programming.

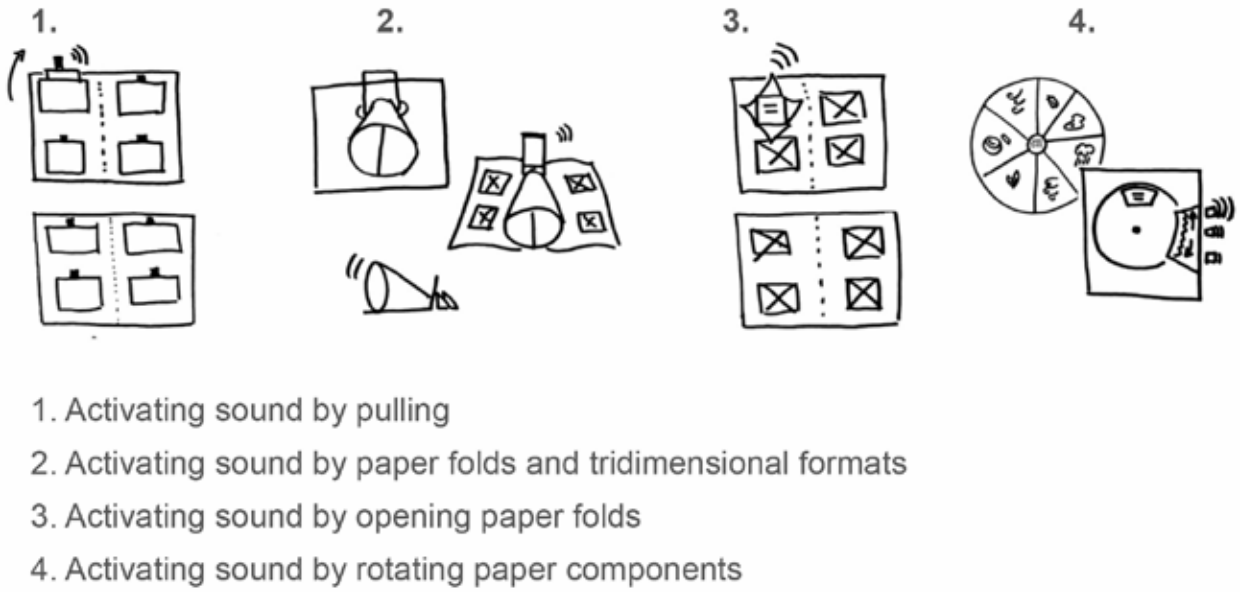

Figure 1. Sketches of folds, shapes, and forms of activating sounds.

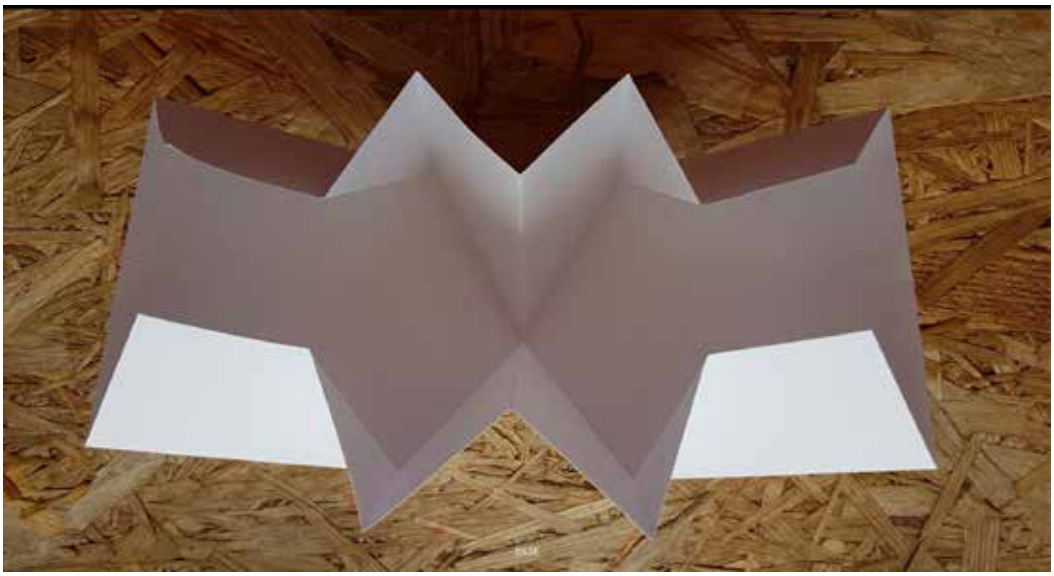

Figure 2. Sample of a Turkish fold made from a single sheet of A4 paper.

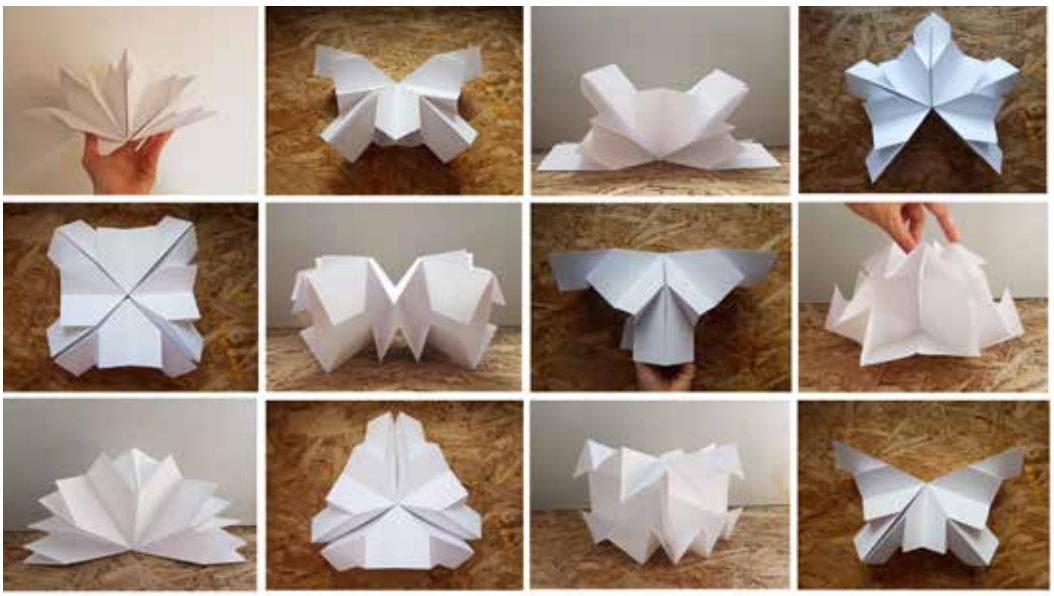

Figure 3. Examples of folding experiments.

2.4.1. The folds

For a more refined physical manipulation of the material combined with the sonorous performance, it was identified that it was required to add volumetry and expand the range of interaction with the object's physicality. For this reason, a process of experimenting with paper folds and origami began, defining the Turkish fold (Figure 2) as the model for the final prototype.

The transition from the first paper models to the creation of the Turkish fold conferred plasticity and a material characteristic that stands out for the discoverability of the opening and closing of the folds. From this unit, a collection of paper sculptures was created (Figure 3).

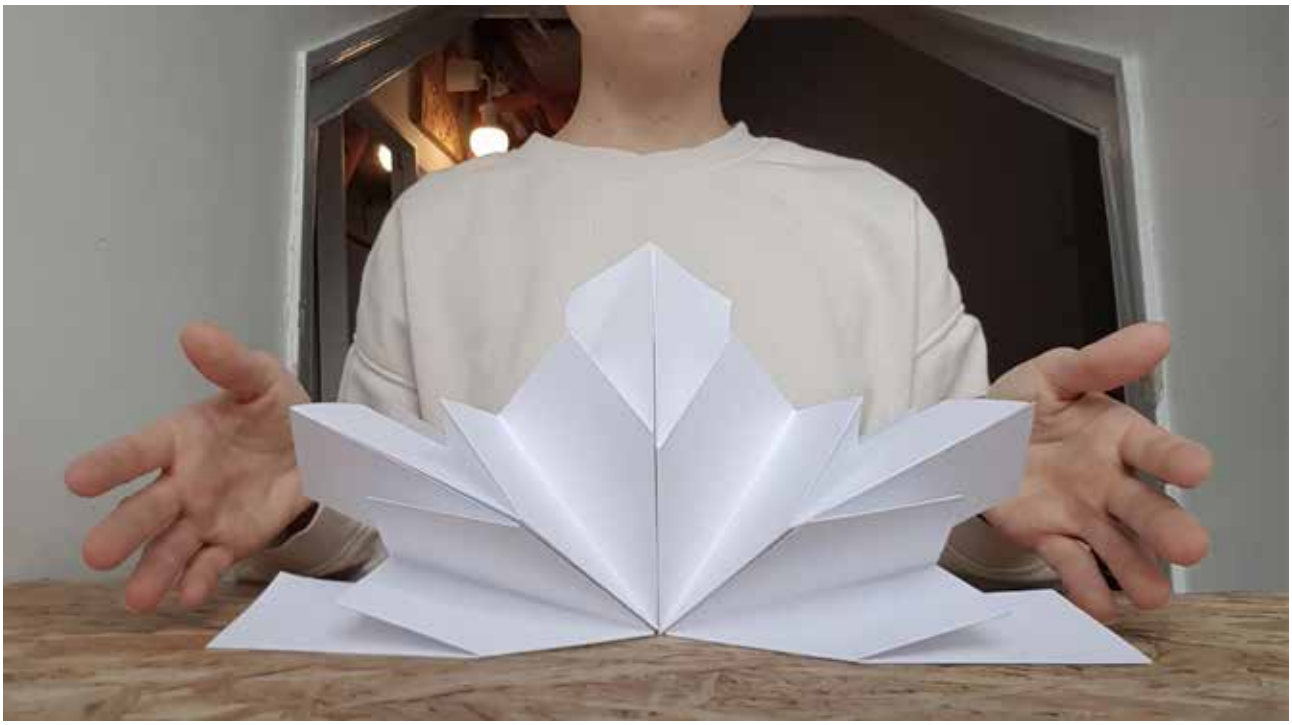

Figure 4. Final model using three Turkish folds altogether.

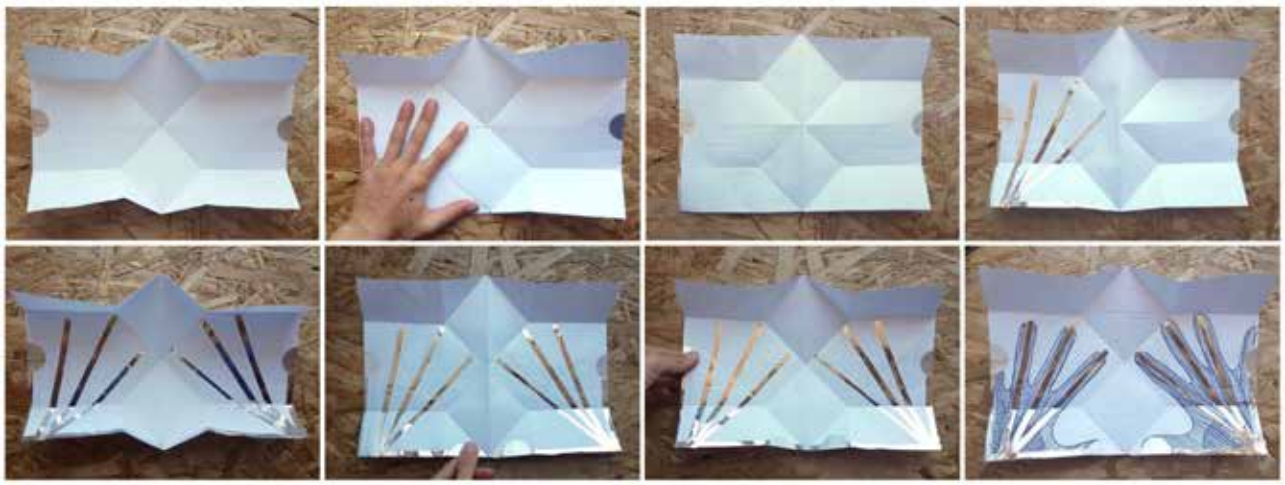

Figure 5. Exploration of the areas of interaction, touch, and pressure.

In order to bring resemblance to a conventional book format, to attend production viability and compressibility, a model was chosen (Figure 4).

2.4.2. Exploring sound and touch interactions

Once the format of the sound-book was chosen, the following phase consisted of establishing the type of interaction and the affordances for sound activation. First, it was

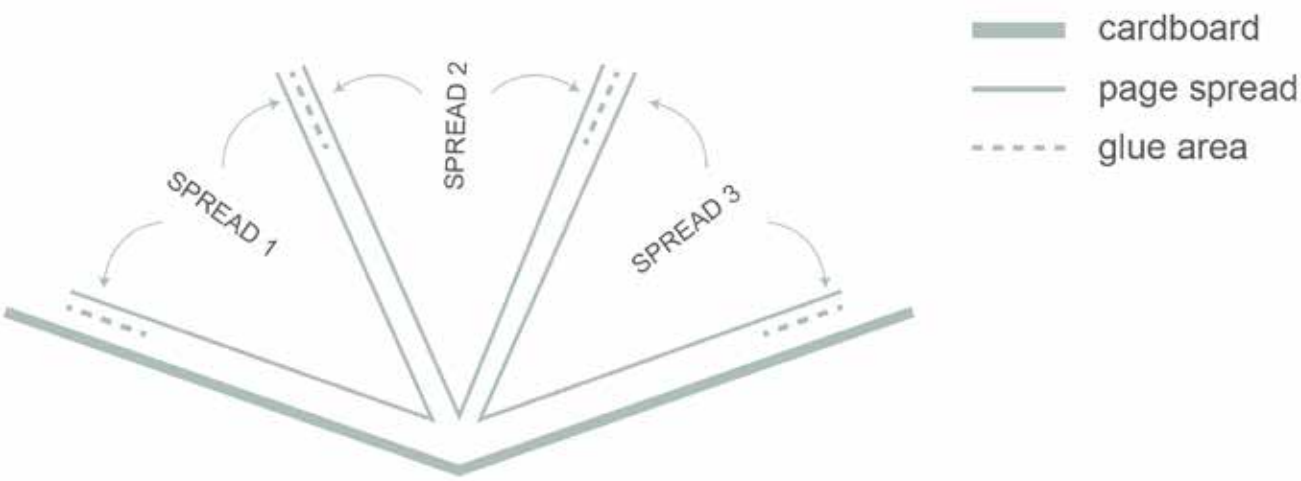

Figure 6. Bookbinding.

defined the area which was seen as the most intuitive for the use of the hands-on pair of pages. Next, it was decided what kind of manipulation would feel more comfortable for touch and finger placement (Figure 5).

The type of interaction was defined by touch and pressure on each spread, determined by the activation of simple sounds and the combination of these sounds into one composition, where each spread would be programmed for presenting two simple sounds and one mixed composition. The reason for deciding on this system was based on the analogy of using hands and fingertips as a common gesture for turning or opening pages of a conventional book.

Three-page spreads were grouped in bookbinding (Figure 6). The first two were chosen to simulate the activation of the audible content. It was determined that each area designated for touch would correspond to the area of placement of the printed sensors.

Two ways of activating simple sounds were defined. The user would have the option to press the left and right buttons placed on the sides of the pages with both index and thumb fingers simultaneously to listen to one simple sound (Figure 7) or by pressing both index fingers on the bottom left and right of the pages to listen to the other (Figure 8). For creating a composition with both simple sounds, it was established to use both hands on each spread, placing index fingers and thumb simultaneously on each button (Figure 9). All the interactions and related sounds are shown in Table 1.

Defining the type of interaction was important not only to investigate if the affordances and functionalities proposed are comprehensible and attractive to the users but also to simulate the printing areas where this technology would be available.

Spread	Activation	
	Button Location	Gesture
Cover	Right edge	Open right to left
Spread 1	Right and left edges	Pressing with fingertips (Figure 6)
	Bottom right and left	Pressing with fingertips (Figure 7)
	Bottom and edges	Pressing with fingertips and thumbs (Figure 8)
Spread 2	Right and left edges	Pressing with fingertips (Figure 6)
	Bottom right and left	Pressing with fingertips (Figure 7)
	Bottom and edges	Pressing with fingertips and thumbs (Figure 8)
Spread 3	No activation	

Table 1 - Prototype functionalities with spread, activation, and sound.

Figure 7. Activation of sounds by pressing with fingertips on the edges of each spread.

Figure 8. Activation of sounds by pressing with fingertips on the bottom of each spread.

Figure 9. Activation of sounds by pressing with fingertips and thumbs of each spread.

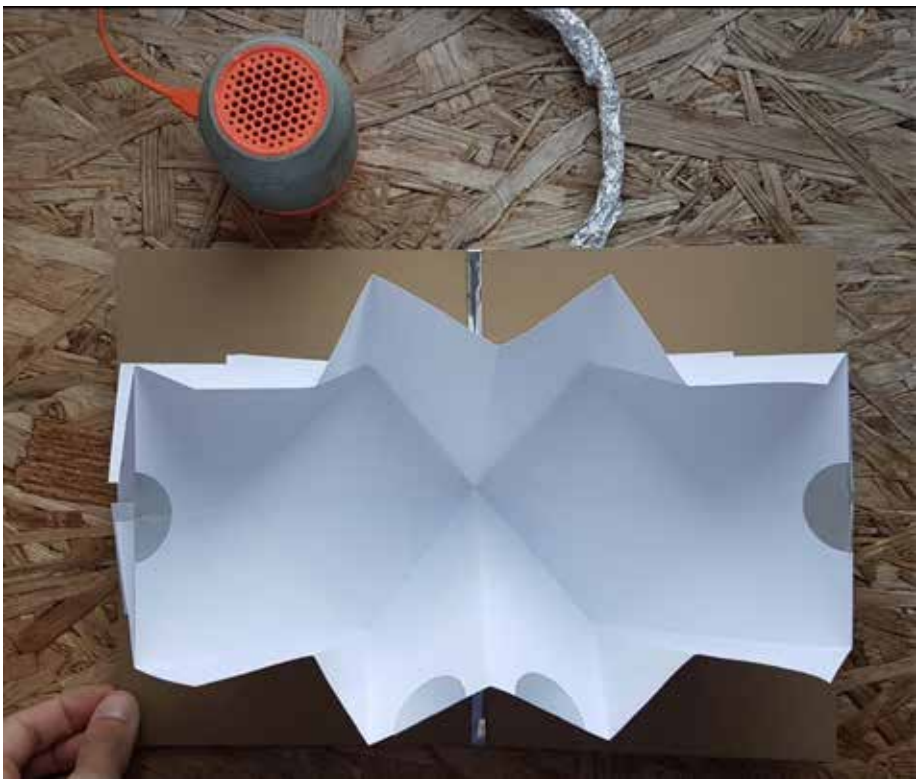

Figure 10. Prototype - Final version for testing.

2.4.3. SoundScape: The Final Prototype

Once the type of interaction and the areas of touch were defined on the paper prototype, the next step was to create a detailed version to be tested with users, in order to evaluate if the affordances were adequate for the user, to effectively perform the sound activation tasks. The final prototype (Figure 10) consisted of a 148 x 210 mm hardcover book with 3 spreads glued to each other. The cover was made of 350g cardboard, and the interior pages were made of 240g white supreme paper.

A metallic adhesive paper was applied in certain areas to signaling where they should be pressed with the fingers, to simulate the electronic sensors. In addition, a Bluetooth soundbox was attached to the sound book, as a reinforcement for the users' perception that the object has a sound component.

2.5. Third Phase: Testing

The testing phase had the overall objective of evaluating the user experience of the final prototype, named "Soundscapes". The goals of Usability and UX then were based on evaluating the understanding of the affordances designed and the task of activating simple and compound sounds. Regarding Emotional Design, it was important to collect impressions of calmness and motivation while interacting with the prototype.

The evaluation consisted of the simultaneous application of three methods: Wizard of Oz (WOz) combined with Think Aloud Protocol, and Self-Assessment Manikin (SAM), and it was conducted on-site and involved six participants, most of them being women between the ages of 21 and 29.
It proceeded with the preparation of the interaction scenario, setting metrics for tasks and corresponding success, defining relevant questions, and applying an emotional scale. After the tests were made there were some adjustments pointed and observed to adjust in the future.

2.5.1. WOz and Think Aloud Protocol

WOz method was chosen to simulate the functionalities of the prototype, to understand how the affordances were understood by the participants as well as their product experience. While the application of the Think Aloud Protocol in association with direct observation aimed to motivate the participants to verbalize their impressions throughout this interaction and observe their manipulation behavior.

The questions addressed to the participants had the purpose of generating insights at the level of affordances evaluation. In this sense, the form of presentation of the prototype is related to the expected form of use, what are their first impressions, and if they were successful in activating the sounds. The test consisted of manipulating the object and delivering questions according to the participants' performance throughout the experience.

Concerning the task of opening the book, all participants were successful in opening the book and recognizing the opening sound. The presence of the Bluetooth speaker contributed to creating the expectation to listen to a sound when opening it. All the subjects expected to have a sound experience at some level.

Regarding sound activation, it was found that the affordances attributed to the sound activation sensors, represented by the metallic adhesives, were not evident to the users. Two participants triggered the simple sounds on the sides of the pages with a light touch, accidentally. One participant, who triggered the simple sounds from the bottom of a page spread, thought it was purposeful as the position favored the idea that it is like a watercourse running down. The three participants who activated the simple sounds noticed that when they turned to the next page and applied the same gesture, they would hear another sound. Since they figured that each page had a different sound output, they failed to explore it sufficiently enough to realize it was also possible to combine them. In the end, they all turned off the book in the same manner, with the same gesture as conventionally it is used to close a traditional book.
The combination of these two methods, along with direct observation, resulted in several indications that emphasize the necessity to adjust the affordances of the prototype as well as the conditions of application of the evaluation. Giving more clear visual and haptic cues, expanding the use of the hands, and providing instructions as support are some suggested changes for the future.

2.5.3. Self-Assessment Manikin (SAM)

After the application of the WOz and Think Aloud methods, the participants were requested to rate the amount of pleasure and calmness during the experience. The Self-Assessment Manikin (SAM) was applied, which aimed to determine whether the experience of using the prototype gave the participants a sense of happiness or unhappiness, excitement or calm.

Figure 11 demonstrates the results of the SAM evaluation, in which each participant is represented by a colored circle. About the valence, the majority indicated a pleasant experience, and one participant perceived the experience as neutral. On the arousal scale, a tendency toward high excitement is observed, and only one participant pointed out that the experience delivered a sense of tranquility.

Thus it can be inferred that the experience brought a considerable level of pleasure and interest, and curiosity about the object, rather than a sense of calmness, which was expected to be achieved. This may have been affected due to the fact of not knowing the a priori state of the participants, the test not being applied in a neutral space, and the participants being enthusiastic about experimenting with something new in itself.

3. Conclusions

In 2019 a global pandemic of coronavirus disease affected people and their everyday life all around the world and changes in the economy and also the society was imposed. The lockdown and other restrictions forced millions of people to stay at home in social isolation for months under emotional stress, fear, and anxiety when facing uncertainties.

Soundscapes is a hybrid book that produces sounds of nature through touch and pressure interaction on printed sensors, with the purpose of reducing stress and anxiety at home, during the pandemic. It was created to resignify the book, not only as entertainment for mental health but as a speculative design for the development of a hybrid interface.

Although the affordances created did not perform as expected, and did not lead to a state of calmness as intended, the experience of use led to a state of happiness. Therefore, it is concluded that the object, although lacking any graphic and visual information, had an appeal to the senses of touch and listening. The manipulation of the paper folds was mentioned as "pleasant" by most of the participants and all the sound stimuli including the sound of turning on generated the participant's expressions of surprise, laughs, and curiosity.

In the future, we suggest some design modifications in the prototype and in the testing phase. The design alterations are defined by creating more affordances, with visual and tactile resources, to understand the functionality more clearly and explore new possibilities to interact, not only with touch and finger pressure but also the movements of the hands, on the pages. Moreover, graphic components such as titles, illustrations, and text can impact the user's behavior, inducing a state of relaxation depending on the aesthetics chosen.

Given the proximity of the interviewer to the participant, the results may have been affected by the expectation of validation in the response. Therefore, it is recommended that the test is conducted in an environment where the prototype can be manipulated freely. Next, it is suggested the evaluation process be recorded and include at least two evaluators, one to observe the gestures and activate the sounds accordingly, and another for interviews in order to reduce bias and to contribute to a more natural experience for the participant.

Furthermore, it is critical to consider the limitations of the study such as the fact the participants were not in the appropriate emotional state for the purpose of the project, which can compromise the results. In the future, these tests have to be applied to subjects who are at targeted levels of anxiety and stress, to better assess the solution.

The number of participants should also be increased in order to provide credibility to the observed behavioral patterns of use. Additionally, the opinion of experts in the mental health area is fundamental to understand how the prototype can prevent mental health disorders in an exceptional context such as COVID-19.

References

Anderson, K., 2017. This Book is a Planetarium. Retrieved 15/07/2021, from This book is a planetarium website: https://kellianderson.com/blog/2017/10/03/this-book-is-a-planetarium/.

Bai, Y., Lin, C. C., Lin, C. Y., Chen, J. Y., Chue, C. M., & Chou, P., 2004. Survey of stress reactions among health care workers involved with the SARS outbreak. Psychiatric services (Washington, D.C.), 55(9), 1055–1057. https://doi.org/10.1176/appi.ps.55.9.1055

Beesdo, K., Knappe, S., & Pine, D. S., 2009. Anxiety and Anxiety Disorders in Children and Adolescents: Developmental Issues and Implications for DSM-V. Psychiatric Clinics of North America, 32(3), 483–524. https://doi. org/10.1016/j.psc.2009.06.002

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G. J., 2020. The Psychological Impact of Quarantine and How to Reduce It: Rapid Review of the Evidence. SSRN Electronic Journal, 395(10227). https://doi.org/10.2139/ssrn.3532534

Brown, A. L., & Muhar, A., 2004. An approach to the acoustic design of outdoor space, Journal of Environmental Planning and Management, 47:6, 827-842, DOI: 10.1080/0964056042000284857

Canbeyli, R., 2010. Sensorimotor modulation of mood and depression: An integrative review. Behavioral Brain Research, 207(2), 249–264. doi:10.1016/j.bbr.2009.11.002

Caplan, S. E., 2007. Relations Among Loneliness, Social Anxiety, and Problematic Internet Use. CyberPsychology & Behavior, 10(2), 234–242. doi:10.1089/cpb.2006.9963

DiGiovanni, C., Conley, J., Chiu, D., & Zaborski, J., 2004. Factors influencing compliance with quarantine in Toronto during the 2003 SARS outbreak. Biosecurity and bioterrorism: biodefense strategy, practice, and science, 2(4), 265–272. https://doi.org/10.1089/bsp.2004.2.265

Grinde, B., & Patil, G., 2009. Biophilia: Does Visual Contact with Nature Impact on Health and Well-Being? International Journal of Environmental Research and Public Health, 6(9), 2332–2343. doi:10.3390/ijerph6092332

Heibeck et al., 2014. Sensory Fiction: A Design Fiction of Emotional Computation. ACM Digital Library. https://dl.acm.org/doi/10.1145/2660579.2660585

Kelaidis, M., 2017. Manokel. Retrieved 15/07/2021, from Completing the Connection Between the Analog and Digital Worlds website: https://www.manokel.com/blink/index.html.

Li, X., Feng, X., Xiao, W., & Zhou, H., 2021. Loneliness and Mobile Phone Addiction Among Chinese College Students: The Mediating Roles of Boredom Proneness and Self-Control. Psychology Research and Behavior Management, Volume 14, 687–694. https://doi.org/10.2147/prbm.s315879.

Liu, X., Kakade, M., Fuller, C. J., Fan, B., Fang, Y., Kong, J., Guan, Z., & Wu, P., 2012. Depression after exposure to stressful events: lessons learned from the severe acute respiratory syndrome epidemic. Comprehensive Psychiatry, 53(1), 15–23. https://doi.org/10.1016/j.comppsych.2011.02.003

Moghaddasifar, I., Fakharzadeh, L., M, F. M., & H, H. Z., 2014. Effect of Multisensory Stimulation on memory in Nursing home residents in Ahvaz . 1(1).

Naylor, C., Parsonage, M., McDaid, D., Knapp, M., Fossey, M., & Galea, A., 2012. Long-term conditions and mental health: The cost of co-morbidities. The King's Fund and Centre for Mental Health.

Nijholt, A. (Ed.), Dijk, E. O., Lemmens, P. M. C. (Ed.), & Luitjens, S. B. (Ed.)., 2010. Haptic and Audio-visual Stimuli: Enhancing Experiences and Interaction. (CTIT Proceedings; No. WP10-01). Centre for Telematics and Information Technology (CTIT). Retrieved 17/04/2021 from University of Twente website: https://research.utwente.nl/en/publications/haptic-and-audio-visual-stimuli-enhancing-experiences-and-interac.

Nilsson, M., & Berglund, B., 2006. Soundscape Quality in Suburban Green Areas and City Parks. Acta Acustica united with Acustica. 92. 903-911.

Ozdemir, L., & Akdemir, N., 2009. Effects of multisensory stimulation on cognition, depression and anxiety levels of mildly-affected Alzheimer's patients. Journal of the Neurological Sciences, 283(1–2), 211–213. https://doi.org/10.1016/j.jns.2009.02.367

Rosária, C., 2019. Diferentes Formas da Materialização de um Livro: Livro Impresso, Livro Digital e Livro Híbrido. 145. Retrieved 17/04/2021, from https://repositorio-aberto.up.pt/bitstream/10216/124823/2/371135.pdf

Sahın, S., Ozdemir, K., Unsal, A., & Temiz, N., 2013. Evaluation of mobile phone addiction level and sleep quality in university students. Pakistan Journal of Medical Sciences, 29(4). doi:10.12669/pjms.294.3686

Schmalstieg, D., & Hollerer, T., 2016. Augmented reality: principles and practice. Boston: Addison-Wesley.

Sellen, A. J. and Harper, R. H., 2003. The Myth of the Paperless Office, em MIT Press.

Shen, X., Wang, J.L., 2019. Loneliness and Excessive Smartphone Use among Chinese College Students: Moderated Mediation Effect of Perceived Stressed and Motivation. Computers in Human Behavior. doi:10.1016/j.chb.2019.01.012.

Sprang, G., & Silman, M., 2013. Posttraumatic stress disorder in parents and youth after health-related disasters. Disaster medicine and public health preparedness, 7(1), 105–110. https://doi.org/10.1017/dmp.2013.22

Staal, J. A., Amanda, S., Matheis, R., Collier, L., Calia, T., Hanif, H., & Kofman, E. S., 2007. The Effects of Snoezelen (Multi-Sensory Behavior Therapy) and Psychiatric Care on Agitation, Apathy, and Activities of Daily Living in Dementia Patients on a Short Term Geriatric Psychiatric Inpatient Unit. The International Journal of Psychiatry in Medicine, 37(4), 357–370. doi:10.2190/pm.37.4.a

Technische Universität Chemnitz., 2021. T-book. Retrieved 15/07/2021, from Tu-chemnitz.de website: https://www-user.tu-chemnitz.de/~schg/t-paper/wordpress/t-book/.

Ulrich, R., 1984. View through a window may influence recovery from surgery. Science, 224(4647), 420–421. doi:10.1126/science.6143402

Unep., 2021. New Report: The Impact of the COVID-19 Pandemic on E-waste in the First Three Quarters of 2020. Retrieved 03/08/2021, from UN Environment Programme website: https://www.unep.org/ietc/news/story/new-report-impact-covid-19-pandemic-e-waste-first-three-quarters-2020

Van den Berg, A. E., Hartig, T., & Staats, H., 2007. Preference for Nature in Urbanized Societies: Stress, Restoration, and the Pursuit of Sustainability. Journal of Social Issues, 63(1), 79–96. doi:10.1111/j.1540-4560.2007.00497.x

Vazini Taher, A., Khalil Ahmadi, M., & Zamir, P., 2015. Effects of multisensory stimulation on cognition function, depression, anxiety and quality of life in elderly persons with dementia. International Journal of Sport Studies, 5(3), 355–360. Retrieved from http:www.ijssjournal.com

Wang, Y., Xu, B., Zhao, G., Cao, R., He, X., & Fu, S., 2011. Is quarantine related to immediate negative psychological consequences during the 2009 H1N1 epidemic?. General hospital psychiatry, 33(1), 75–77. https://doi.org/10.1016/j.genhosppsych.2010.11.001

Wegrzyn,W., 2012. Elektrobiblioteka. Retrieved 15/07/2021, from Post-Digital Publishing Archive website: http://p-dpa.net/work/elektrobiblioteka/.

World Health Organization., 2020. Mental health and psychosocial considerations during the COVID-19 outbreak Geneva: Author. Retrieved 15/07/2021, from https://www.who.int/docs/default-source/coronaviruse/mental-health-considerations.pdf

World Health Organization., 2014. Public Health Implications of Excessive Use of the Internet, Computers, Smartphones and Similar Electronic Devices Meeting report. Retrieved 15/07/2021, from website: https://apps.who.int/iris/bitstream/handle/10665/184264/9789241509367_eng.pdf?sequence=1&isAllowed=y.

Wu, P., Fang, Y., Guan, Z., Fan, B., Kong, J., Yao, Z., Liu, X., Fuller, C. J., Susser, E., Lu, J., & Hoven, C. W., 2009. The psychological impact of the SARS epidemic on hospital employees in China: exposure, risk perception, and altruistic acceptance of risk. Canadian journal of psychiatry. Revue canadienne de psychiatrie, 54(5), 302–311. https://doi.org/10.1177/070674370905400504

A Study on Interaction with Medication Package Inserts: Designing an Accessible System

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Abstract
The article describes the process of an interaction design project, A BULA, which aims to address several usability and accessibility issues found in medication package inserts. These printed objects contain required legal information and are also the leading source of information for medication users about taking instructions, dosage, or side effects. The main goal of the project was redesigning a leaflet that facilitated access for users, since during an exploratory phase issues about readability, usability, and clarity were found.
Using a research through design methodology, we also created a design system that expands interaction with medication information, composed of printed and digital artifacts that complement and complete each other, not excluding the relevance that each one has individually. During the generative phase, we applied a set of methods, namely mind maps, information architecture, user journey maps, wireframes, and prototypes. An evaluation phase included performance tests and revealed positive results regarding the adopted design strategies, as well as valuable insights for further developments.

Keywords: Interaction design, Information design, research through design, medicine package inserts

1. Introduction

Package leaflets are a technical document containing all the information about the medicine that it accompanies. In accordance with Article 54 of Directive 2001/83/EC (European Commission, n.d.), a package leaflet must contain specific information about the medicine, respecting a logical organization and hierarchy of information. Article 61 states package leaflets must be written and designed to be clear and understandable, enabling users to act appropriately, when necessary with the help of health professionals.

Over the years more users have been seeking self-medication (Bennadi, 2013). This growing trend arises for a variety of reasons, such as the urge to self-care, lack of health services, financial constraint, and misbeliefs (Phalke et al, 2006). Users have more access to information and can play a more active role in their health care (Bennadi, 2013), but the associated potential risks include incorrect self-diagnosis and difficulty in recognizing warnings and precautions. Situations such as taking inappropriate medications due to quantity, durability, or even incompatibility with other medications or foods, stand out (Bennadi, 2013).

Self-medication can be considered adequate when medicines respect a set of rules, namely, the fact that they are accompanied by package leaflets with sufficiently clear and complete information, enabling the safe, effective, and rational use of the medicine (World Health Organization, 2000). It is therefore considered that package leaflets are essential artifacts for the health care system.

A BULA is an interaction design project with the purpose of addressing accessibility and usability issues detected in the most common medication leaflets. The paper describes a research through design process with three main steps: an exploratory phase applying various user-research methods, a generative phase with the development of an artifact system consisting of an alternative package leaflet template and a mobile application, and an evaluative phase of user testing.

During the first phase we collected data through performance tests and a questionnaire about whether package leaflets are used; how often, under what conditions, what information is most sought after. The majority of the sample indicated frequent difficulties regarding information comprehension.

Thus, the project's main goal was to conceive a format that would allow information to be read in an effective, and clear manner. It should also be able to adapt to any volume of information. To expand the possibilities of interaction a secondary goal was to create a digital artifact that could complement the package leaflet.

The project was also motivated by concerns of sustainability and accessibility. The design process made sure print and digital components were accessible to a wide audience, taking into account various aspects of legibility, readability, and intuitiveness of use. And considering each medication requires a printed medical leaflet, the use of recycled and recyclable paper was a priority. According to The World Counts (n.d.), it takes 324 liters of water to make 1 kilogram of paper, and about 10 liters of water are needed to make one sheet of A4 paper, so issues of paper production were taken into account.

The project fits into SDGs (Sustainable Development Goals) Goal 3 - "Ensure healthy lives and promote well-being for all at all ages" - as it intends to address issues of accessibility to medication information, impacting the overall health care system.

2 . Theoretical Background

2.1. Interaction design

Interaction design is an expanding discipline situated in increasingly complex scenarios, due to rapid technological innovations that encompass new interaction modalities and new hybrid interactive systems (Wiberg, 2018). Ubiquitous computing, Internet of Things, AI or virtual and mixed realities are some of the new contexts in which interaction design plays a defining role in shaping current human experience (Schwab, 2015).

Interaction design emerged as a practice informed by notions of HCI (Human-Computer Interaction), involving computing, psychology, cognitive and behavioral sciences, and human factors engineering (Carroll, n.d.; Blevis & Stolterman, 2009). In the late 1970s, with the development of personal computers and subsequent needs to adapt interfaces to make them accessible to users without technical computer knowledge, designers started to intervene in those systems, developing not only the graphical interface but also designing new models of interaction. (Moggridge, 2007; Zimmerman, Forlizzi & Evenson, 2007).

Due to such historical beginnings, the term interaction design has been associated as pertaining to the digital environment (Buchanan, 2001), and although the field encompasses areas dedicated to designing human interactions with digital artifacts, like ID (interface design) or UX (user experience), interaction design can be considered in a broader sense. Interaction design addresses four dimensions, taking into account space and time, and regarding elements that change and react to user inputs in a time frame (Cooper, Reimann & Cronin, 2007) and in this sense the scope of interaction includes the design of experiences mediated by various kinds of artifacts (Heeter, 2000).

Considering interaction design as "the creation of a dialog between a person and a product, service or system" (Kolko, 2010, p. 11), it regards the facilitation and mediation between human beings and physical objects, communication artifacts or immaterial touchpoints of a service, either in professional or personal realms (Rodgers, Sharp & Preece, 2011). Also, it shapes "how human beings relate to other human beings through the mediating influence of products" (Buchanan, 2001, p. 11). The material object of interaction can be digital, physical, or hybrid and its diversity shapes the whole socio-technical fabric, designing experience and meaning (Davis, 2008; Höök & Löwgren, 2021).

2.2. Design for communication and information

Communication design conveys messages and creates meaning by producing visual communication that combines textual and graphic elements in a structured and organized

way (Frascara, 2004). Its effectiveness is dependent on handling form, content, and context in a suitable way for users, also taking into account media, experience, and interaction (Grefé, 2011; Neves, 2020).

Although communication design is historically intertwined with more formal approaches that structure information visually, when graphic artists became graphic designers (Frascara, 1988; Hollis, 1997), it has evolved into a broader and more complex area as the design domain moves from the production of artifacts to the production of immaterial outcomes (Buchanan, 2001; Sanders & Stappers, 2008). Based on interdisciplinary cooperation, affected by rapid technological development and responding to increasingly complex problems (Icograda, 2011; Dur, 2014; Davis & Hunt, 2017), communication design has a role in the production and circulation of social meanings (Dorst, 2012).

Within communication design, information design is dedicated to organizing information in an easily accessible manner to users (Saffer, 2009), ensuring effective communication which facilitates perception, understanding, and memorization (Frascara, 2015). By processing and manipulating data, information design transforms and structures textual, numerical, and graphic elements (Wildbur & Burke, 1998), thus enabling knowledge, interpretation, and gaining of insights (Figueiras, 2016). Clarity, precision, legibility, readability, accessibility, and appropriateness are some of the principles that guide information design to help users attain their goals (Tufte, 1990; Horn, 2000; IIID, 2007).

The information design process is described by Frascara (2015) by a sequence of steps: identification of a need; collection of information; development of a design strategy; design development and production of prototypes; evaluation; redesign; production and implementation; and final evaluation followed by revision and adjustment.

2.3. Medicine information design

Medicine package inserts are print artifacts in which information design plays a particularly relevant role since correct comprehension of the content is crucial in preventing accidents or medicine misuse and enabling users to take appropriate action (Frascara, 2015; Waarde & Spinillo, 2015). A comparative study of package leaflets (Dickinson et al. 2010) points to recommendations for their redesign that contribute to enable more efficient interactions. Formats that allow smaller columns of text, while also providing white space between each block of information, offer different reading entry points, offer selective reading, and facilitate user interaction. Typographical hierarchy and highlighted sections that allow users to find the most frequently consulted information are relevant features in creating an organized document and may facilitate reading by a wide variety of users (Dickinson et al. 2010).

All these features allow the creation of an effective and clear object, increasing readers' confidence in the message's content. Visual presentation of information impacts legibility and readability, as well as the chances of the leaflet being read and its recommendations implemented (Frascara, 2015).

The positive impact of applying design guidelines is recognized by European regulatory authorities, which are responsible to check if visual information is suitable, correct, and accessible, thus enabling the use of information even among people with poor eyesight or literacy skills (European Commission, 2009; Waarde & Spinillo, 2015).

Although package inserts remain the primary source of regulated medicine information for a majority of users (Dickinson et al. 2010), more and more request and utilize health-related services on digital platforms, so health providers are increasingly present in digital systems. According to European Commission Eurostat "In the last three months prior to the 2019 survey on the use of ICT in households and by individuals, one in two EU citizens (53%) aged 16-74 reported that they sought online health information related to injury, disease, nutrition, improving health or similar. This was two percentage points (pp) higher than the previous year (53% compared with 51%) and up by 19 pp from 2009 (32%)." (Eurostat 2020).

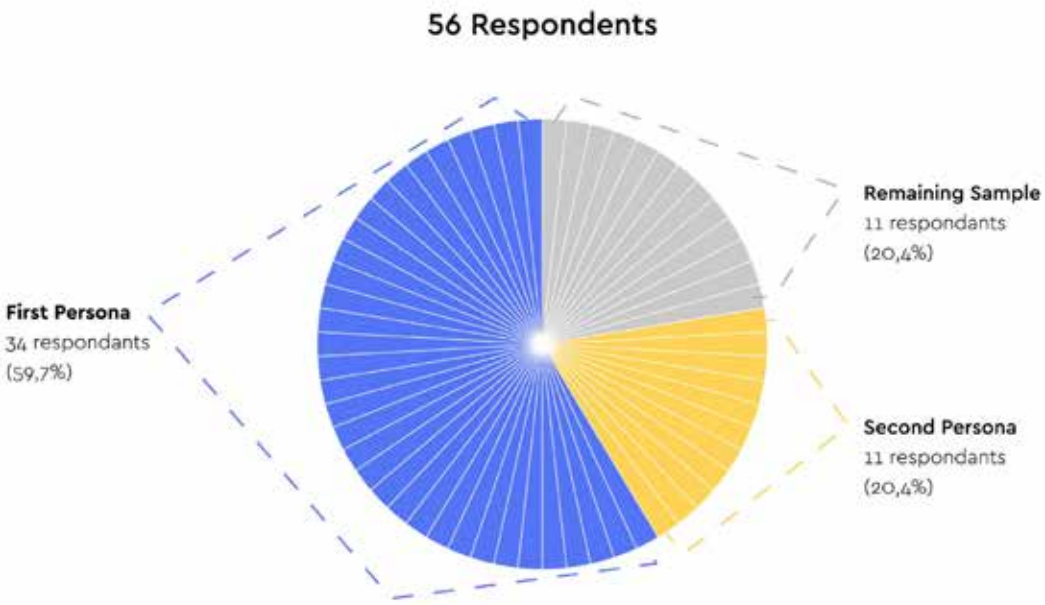

Figure 1. Graphic representation of the questionnaire's full sample divided in the developed personas.

3. A BULA - a design process to improve usability and accessibility

The project had as its initial objective facilitating user interaction with medicinal leaflets. We adopted a methodology divided into three phases, each one applying a set of methods. An exploratory phase had as its main goal gathering information about medication leaflets user's and consisted of a questionnaire, a performance test, and the creation of personas. A generative phase sought the creation of innovative medicinal leaflet systems using a research through design process and applied methods such as mind maps, information architecture, wireframes, visual identity development, user journey maps, and prototypes. In the last phase, we conducted an evaluation with potential users.

3.1. Exploratory phase

The gathering of information started with a questionnaire structured on Google Forms and disseminated through digital platforms. The main objectives were to understand the current existing interaction that the sample has with package leaflets, namely circumstances that make them consult package leaflets, regularity of use and what other means are used to gather information about medicines. It was also intended to collect positive and negative characteristics of package leaflets and to find out about the acceptance of a proposal that could improve the information search experience. Fifty-six participants answered the questionnaire. Data processing gave us decisive information for the project, since regarding the question "Do you use Medicinal Leaflets?", 80.7% of the sample said yes. Relating to the frequency of use, on a scale where 1 corresponds to infrequent and 10 to very frequent, 70.2% of the sample answered between 6 and 10. This made clear that the redesign of the package leaflet was a priority over a digital solution.

Through this data, it was possible to collect information that facilitated the creation of personas. This method originates archetypal profiles of the target audience, based on data collected with users and synthesizing behavior patterns, needs, motivations, and common characteristics, facilitating a human-centered approach to the design process (Martin & Hanington, 2012; Stickdorn, Hormess, Lawrence & Schneider, 2017). From data processing, it was possible to divide the total sample into groups that are characterized by the similarity and closeness of the answers given to each question of the questionnaire (figure 1).

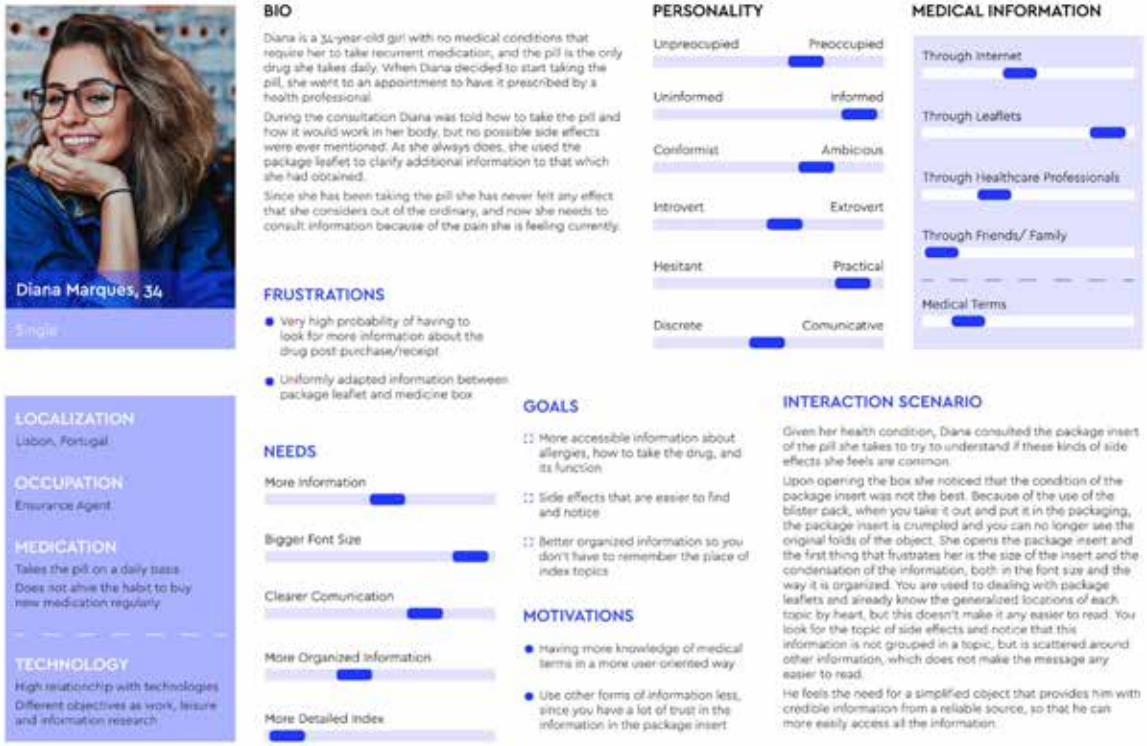

Figure 2. Persona 1.

Figure 3. Persona 2.

Positive Aspects	
Grid Organization (100%)	Colored Highlighted Topics (50%)
Illustrations (75%)	Font Size (50%) Bigger that usual
Topic Spacing (75%)	Higher paper gram (25%)
Format (75%) Booklet	Text Color (25%) Blue
Font (75%) Non-Serif	

Table 1. Positive characteristics indicated by the sample.

Negative Aspects	
Info. Organization (100%)	Bad Index (50%)
Folds (100%)	Text Volume (25%)
Font Size (100%) Usual	Text Color (50%)
Topic Spacement (75%)	Font (25%) Serif
Format (75%) Unusual	

Table 2. Negative characteristics indicated by the sample

The two created personas (Figure 2 and 3) reflect distinct characteristics, such as age group, and different needs. Persona 1 needed information from package inserts that was neither clear, objective, or easy to find. Persona 2 represents senior users with difficulties in searching for information in medicinal package inserts, due to font size and confusing content organization. Not using digital technologies, they resort to other means such as health professionals to obtain the information they need.

For further data collection, a performance test was conducted regarding five existing medicinal leaflets, distinguished by features such as format, size, font type, and use of color, with a sample of four respondents.

The goal of this test was to measure times of opening and closing each package insert, as well as the search for information on side-effects, a topic identified as very relevant for users through data collected in the questionnaire. This test also allowed us to note general positive and negative aspects that participants mentioned about each leaflet, as well as to observe user interaction with the printed object, allowing us to identify trends and gain insights for the generative phase (tables 1 and 2).

3.2. Generative phase

The research through design process consisted in the development of low, medium, and high fidelity paper prototypes, to obtain a package leaflet that addressed identified issues in the previous phase, and in the creation of a mobile application that resulted from the development of an information architecture, wireframes, user-flows and digital prototypes.

3.2.1. The design system

The redesign of an analog physical object was considered a priority since it is a legal imposition that medicines must always be accompanied by a package insert and because data revealed these are utilized by most users and don't entirely fulfill their function. Nonetheless, it was also considered that using digital technologies in a complementary way could benefit the project since digital systems are nowadays ubiquitous to access information in more and more parts of the world. We developed a mobile application that prioritizes accessibility, usability and can be customized to fit user needs, a feature that could not be fulfilled by the leaflet. Figure 4 shows the designed system, its main features and main goals to be addressed by each component.

3.2.2. Package insert prototyping

Paper prototypes were used to test ideas to reformulate a birth control pill package insert, since it is a commonly used medicine within a group of participants from the sample, and which requires the user to frequently search for side-effects information. As shown by figure 5, paper prototypes were carried out looking for a folding system to allow the existence of separators. The main goal was for information to be possible to read while the object is partially or fully opened. Afterwards, prototypes of medium definition were developed, testing grid systems, layout and typography (figure 6).

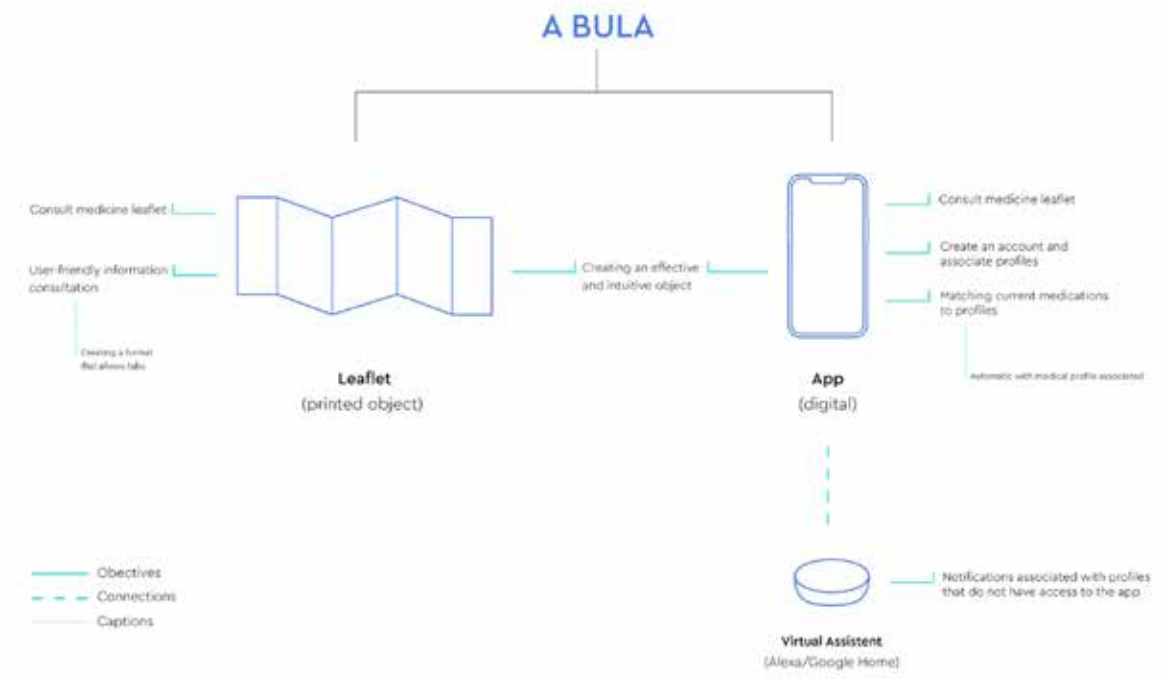

Figure 4. Map of the design system.

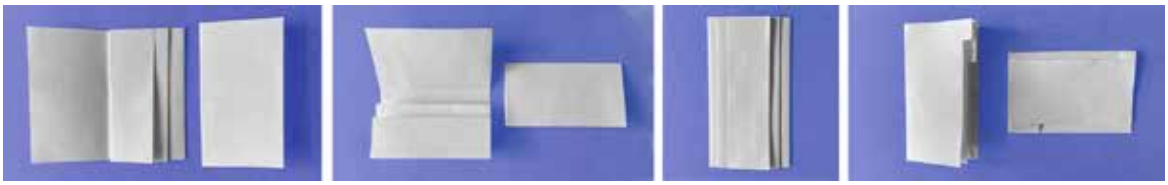

Figure 5. Research through design - format testing.

Figure 6. Leaflet planification.

Figure 7. Interaction with leaflet (storyboard part 1) - When the user comes across the package insert, the name of the medicine is the only visible information. By scrolling down the package leaflet, the reader finds the most relevant information. When the first page is fully opened, tabs will be available that lead to other pages of information.

Figure 8. Interaction with leaflet (storyboard part 2) - Continuing to leaf through, in order for the reading to be continuous, when the user turns the last page the back tabs will be visible. In this way the reader has the possibility to access all the information.

Figure 9 Interaction with leaflet (storyboard part 3) - The same happens on the last page. When turned over, the reader will see the initial page of the leaflet. For proper storage, the user will only have to make a first fold in the middle, and then the object will almost fold itself.

By creating creases and thus more intuitive folds, the leaflet can be stored in its packaging without difficulty and without the blister impairing its preservation status, a relevant issue indicated by the questionnaire respondents.

Typography size and leading were increased to make it faster and more effective to read. Compared to the original package leaflet, the format is reduced in size, aiming at reducing paper consumption. Also, the choice of paper (Ahlstrom-Munksjö - PrintClassic Thin Paper 50g, FSC® certified) considered recycling and sustainable production standards. The leaflet is only printed in black, limiting visual clutter and increasing visual contrast, thus making it more adequate when regarding universal design.

Finally, a high-fidelity prototype was made to assess the interaction with the object, and iterate where necessary. The storyboard of a hypothetical usage can be seen in figures, 7, 8 and 9.

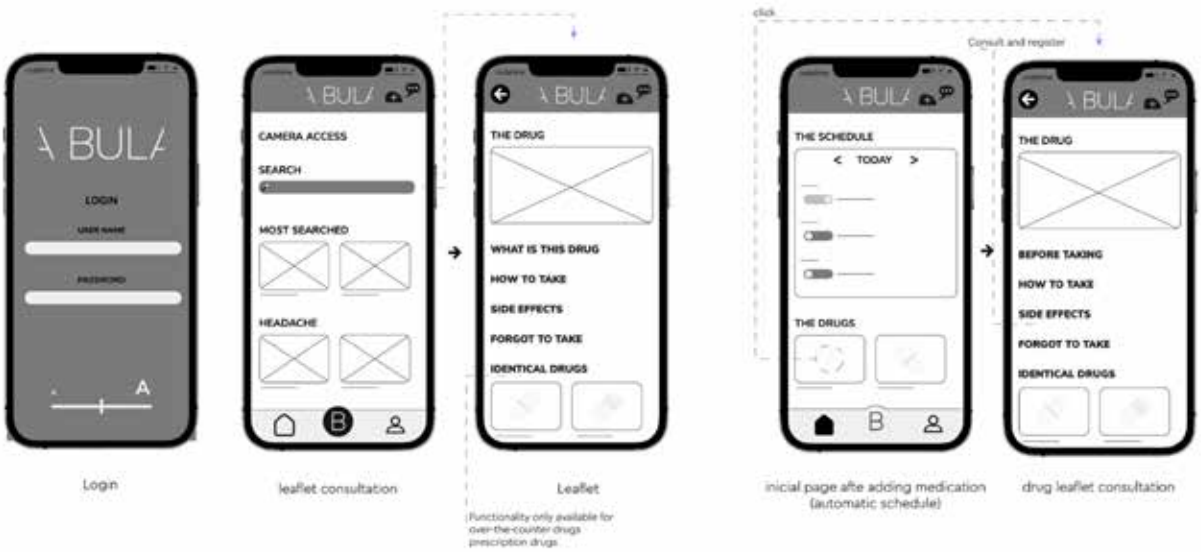

Figure 10. Mobile application wireframes - Main screens and features.

3.2.3. Mobile application

The developed app addresses the goal to complete the design system with a digital component of reliable sources that facilitates searching and accessing the more relevant contents of medicinal leaflets. Also, due to the legal impossibility of improving some negative aspects of package leaflets mentioned by respondents, the mobile application intends to serve as a complement to unblock impediments such as language clarity, medical terms, and drug components.

In an initial phase, we mapped an information architecture, making it possible to add and discard essential and non-essential app functionalities. To facilitate the interface design process we then designed wireframes so information could be organized and screens could be structured (figure 10).

The interaction with the application starts with the registration of a user account that requires only username and password, and unless the user indicates it, no personal information will be requested (although it is possible to associate a medical profile and current medication). When creating an account or logging in, users can increase or reduce the font size displayed on screen.

After log in, it is possible to search for a medicine to see the contents of the package insert displayed in an easy to read, categorized, and hierarchized manner, informed by the most relevant topics previously indicated by questionnaire respondents. Searching can be done by text, photograph of the medicine's box or by pathologies. Suggestions of the most searched package inserts and by pathologies are also visible on this screen.
Considering customization, the user also has the possibility of associating medicinal leaflets to various profiles, allowing for quicker access, as well as medicine taking schedules and treatment duration.

Another accessibility feature is the possibility to connect to a virtual assistant, allowing for voice interaction with the system: the user can ask questions about medicine information, and listen to notifications to take medication.

The following step of the generative phase was the creation of a visual identity system, contributing to communicate in a clear, coherent, and direct way. The logo is based on a visual metaphor of the package leaflet, facilitating the identification of the theme that the system is about.

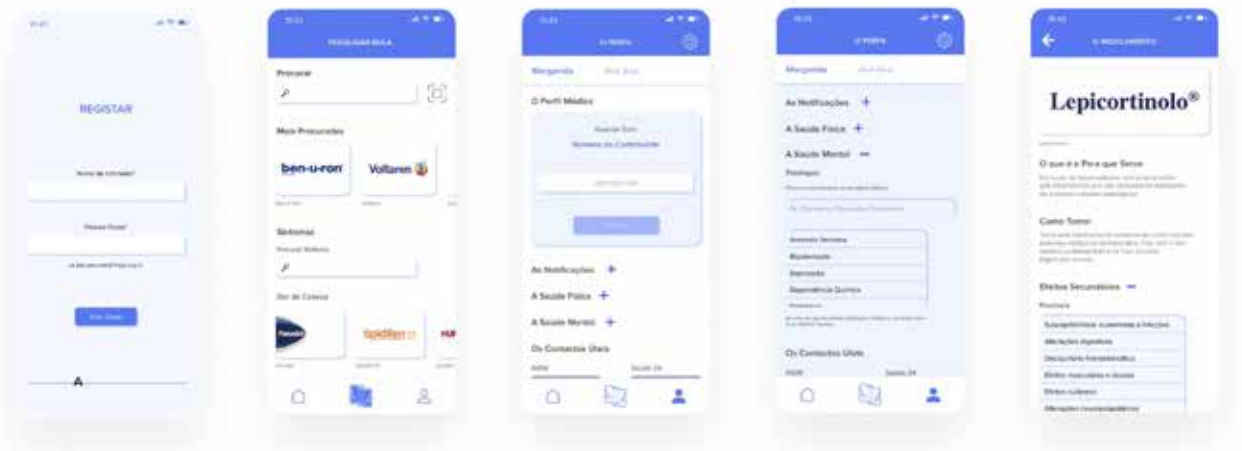

Figure 11. Mobile application prototype - Different features and possibilities of interaction with the app.

Figure 12. Logo deployment for different contexts

Figure 13. Mobile application prototype - Color implementation.

The graphic interface uses a color palette that facilitates usability. Two shades of blue were used as main colors, complemented with a shade of yellow for illustrations and a green tonality for selection indications. Color is also used in success and error messages, producing a green or red tonality in interface illustrations (figure 13)

3.3. Evaluation phase

The evaluative process was divided in two phases, the first one to evaluate the printed leaflet, and the second meant to evaluate the mobile application.

The printed package insert was subjected to performance tests to evaluate usability and effectiveness. Six participants evaluated the original and the proposed package leaflet. Regarding counterbalancing procedures, the sample was equally divided by gender and age group. Participants manipulated the two package leaflets to perform tasks, not knowing which would be which, and on different days to eliminate the learning factor. Due to technical constraints leaflets were printed on 80 g/m2 paper, instead of the proposed 50 g/m2 paper.

All tests took place under the same conditions and face-to-face, making it possible to record the interaction of each participant's hands with the leaflets and take note of participants' emotions and comments.

Usability Datalogger v5.1.1. and Microsoft Excel were used to record the time each participant took to perform the tasks, level of ease to perform them, or even if they did not complete them. The proposed tasks regarded various possibilities of interaction (e.g. open the leaflet, find a topic) and different degrees of difficulty.

Results show very different levels of task performance for each leaflet (figure 14). The proposed package insert produced better performances in completing tasks. From this evaluation it was also possible to detect issues with the prototype (as in task 4, indicating a search for information that was found on the package insert's reverse side) which allowed for posterior development of an improved prototype.

After a performance test with each leaflet, each participant was asked to complete a questionnaire presented in Usefulness & Ease of Use (TAM) format so that, on a Likert scale of 1 to 7, respondents would indicate their level of agreement with statements read by the test evaluator. Levels of perceived ease of use and usefulness referring to interactions with the original leaflet are significantly low when compared to results with the designed package insert (figure 15).

Finally, participants were asked to fill out a Self-Assessment Manikin (SAM) test, regarding three dimensions: dominance, arousal, and pleasure. Each participant should indicate on a scale of 1 to 9 their feelings related to each dimension. Resulting data relating to the interaction with the proposed package leaflet is more positive than when the interaction was carried out with the original package leaflet (figure 16). With the proposed leaflet, participants felt that they were in mastery of the tasks.

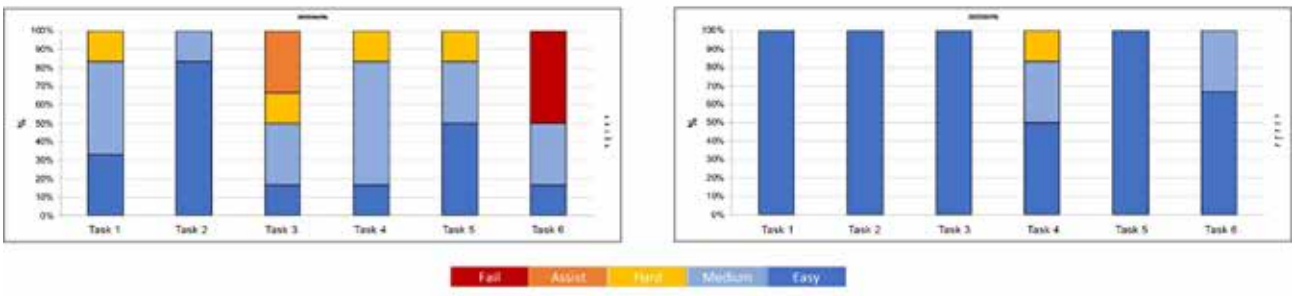

Figure 14. Participants task performance data with original (left) and proposed leaflet (right).

	Perceived Usefulness & Ease of Use	M	Strongly disagree 1	2	3	4	5	6	Strongly agree 7
1	Using this product enables me to accomplish tasks more quickly.	2,4							
2	Using this product improves my current performance.	2,3							
3	Using this product increases my productivity.	2,7							
4	Using this product makes me more effective.	2,9							
5	Using this product makes it easier to do my work.	3,0							
6	I find this product useful.	5,0							
7	Learning to operate this product was easy for me.	3,4							
8	I found it easy to get this product to do what I want it to do.	3,0							
9	My interaction with this product was clear and understandable.	2,6							
10	I found this product to be flexible to interact with.	3,3							
11	It was easy for me to become skillful at using the system.	3,1							
12	I found the system easy to use.	2,3							
	USEFULNESS	3,0							
	EASE OF USE	3,0							

	Perceived Usefulness & Ease of Use	M	Strongly disagree 1	2	3	4	5	6	Strongly agree 7
1	Using this product enables me to accomplish tasks more quickly.	6,6							
2	Using this product improves my current performance.	6,6							
3	Using this product increases my productivity.	6,7							
4	Using this product makes me more effective.	6,9							
5	Using this product makes it easier to do my work.	6,4							
6	I find this product useful.	6,9							
7	Learning to operate this product was easy for me.	6,0							
8	I found it easy to get this product to do what I want it to do.	6,3							
9	My interaction with this product was clear and understandable.	5,9							
10	I found this product to be flexible to interact with.	6,6							
11	It was easy for me to become skillful at using the system.	6,4							
12	I found the system easy to use.	6,6							
	USEFULNESS	6,7							
	EASE OF USE	6,3							

Figure 15. Questionnaire's data representation of the full sample considering the original (left) and the new leaflet (right).

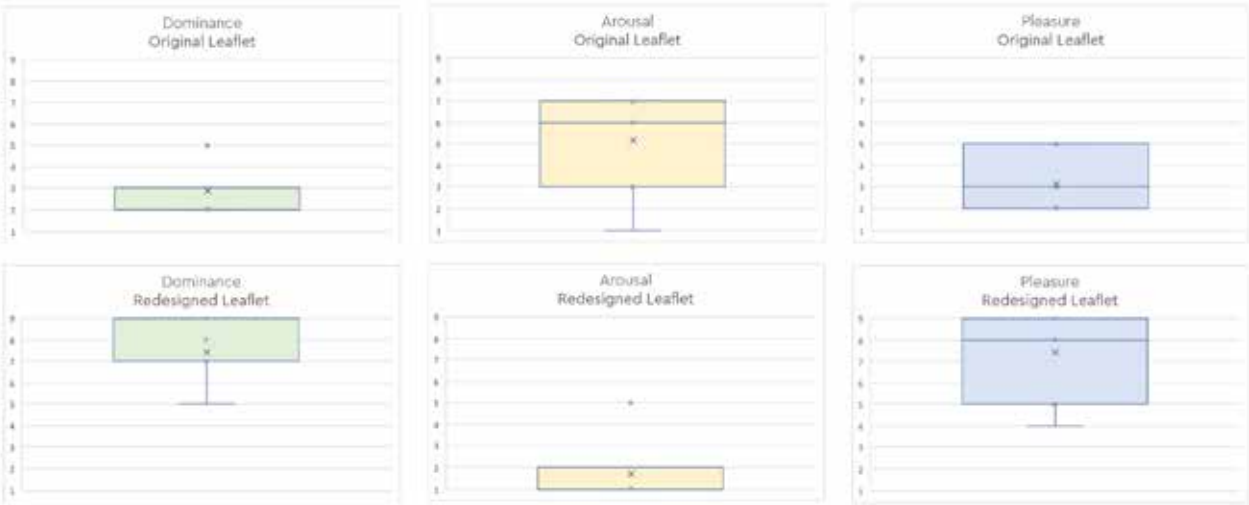

Figure 16. SAM numerical responses representation of the full sample considering the original (top) and the new leaflet (bottom).

To evaluate the mobile application we conducted a heuristic evaluation, the only method that does not rely on the participation of a sample. The heuristics, related to graphical interfaces, were consistency, efficiency, feedback, and easy error recovery. The different types of consistency were visual, functional, internal and external.

Regarding efficiency, user navigation was considered such as user dialogs with the product/system, reducing user short-term memory, minimization, designing to capture the user's attention and readability. Considering feedback the main topic was error messages. For the easy recovery of errors, topics such as avoiding the use of keyboard for text input, reporting the error in question in the correct place, as well as the error being properly identified were taken into account.

After the evaluation tests data analysis, a new version of the printed leaflet was designed to address encountered problems (figure 18). Tabs were highlighted in shades of gray to make them more visible and a reference was added in the first page when the package insert is open, to highlight the information available on the back of the object.

Conclusion

As leaflets are the main source of information for medication users, it was necessary to understand whether this usage is carried out effectively. Based on data obtained through different methods and by a research through design process, it was possible to propose a format that, subjected to evaluation tests, was considered by the sample to be more effective when compared to the original.

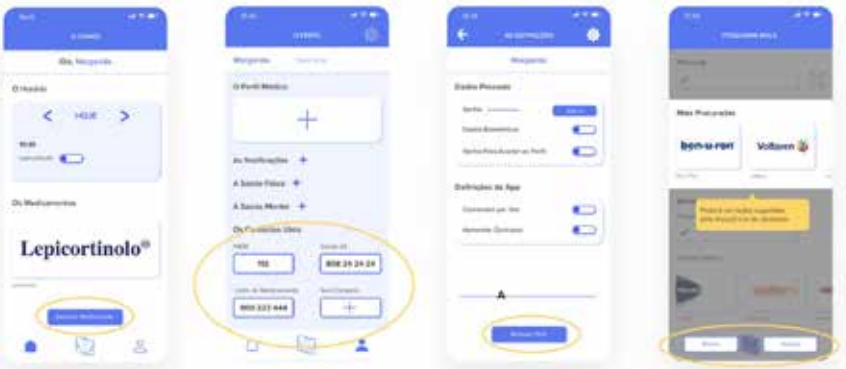

Figure 17. Efficiency - Considering the way we hold our devices, as in ergonomic terms, it was meant to use comfortable areas for touch on a screen called the 'thumb zone' to facilitate user interaction with the main functions.

Figure 18. Final leaflet prototype details.

Although data from the exploratory phase showed that most participants assumed that textual content in a grid made it easier to read and search for information, our results point out other strategies that can be adopted to make search for information significantly easier. Even though the original medication visual language was not changed, changes made regarding layout, information organization and folding format made it possible for participants to consider that searching for information is carried out faster and with more clarity.

Regarding further research, it will be necessary to subject the final package insert prototype to evaluation tests. Those tests should consider the following: participant samples should be larger even though the identified tendencies were satisfactory for the goals set for this project; the format and proposed design strategies should be adapted to variable volumes of information, and to different medication leaflets; it will be necessary to print the same number of leaflets as the number of participants that make up the sample so that each one can perform evaluation tests with the same level of paper conservation.

Also, further user research is needed to deepen understanding about the nature of information retrieval. It will be relevant to do a targeted study with the part of the sample that declared not consulting package leaflets, in order to understand where, how and why these users obtain information, allowing for the identification of pain points that could be addressed by the created design system.

Concerning the application component, further evaluation should be conducted, to identify opportunities for the design system to function in a complementary way.

Acknowledgments

We would like to thank the participants who generously shared their time for the purposes of this project.

References

Bennadi, D, 2013. Self-medication: A current challenge, Journal of basic and clinical pharmacy, 5(1), 19.

Blevis, Eli and Stolterman, Erik, 2009. The Confluence of Interaction Design & Design: from Disciplinary to Transdisciplinary Perspectives, Undisciplined! Design Research Society Conference 2008, Sheffield Hallam University, Sheffield, UK, 16- 19 July 2008

Buchanan, R., 2001. Design research and the new learning, Design issues, 17(4), 3-23.

Carrol, J. M. (n.d.). Human Computer Interaction - brief intro. Retrieved July 30, 2021, Retrieved from https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/human-computer-interaction-brief-intro

Cooper, A., Reimann, R., & Cronin, D., 2007. About face 3: the essentials of interaction design, John Wiley & Sons.

Davis, M., 2008. Toto, I've got a feeling we're not in Kansas anymore…. Interactions, 15(5), 28-34.

Davis, M., & Hunt, J., 2017. Visual communication design: An introduction to design concepts in everyday experience, Bloomsbury Publishing.

Dickinson, D., Teather, J., Gallina, S., & Newsom-Davis, E., 2010. Medicine package leaflets–does good design matter?, Information Design Journal, 18(3), 225-240.

Dorst, K.: Frame innovation. Create new thinking by design, MIT Press, Cambridge, MA, 2012.

Dur, B. I. U., 2014. Data visualization and infographics in visual communication design education at the age of information, Journal of Arts and Humanities, 3(5), 39-50

European Commission, 2009. Guideline on the readability of the labelling and package leaflet of medicinal products for human use.

European Commission, (n.d.). Directive 2001/83/EC, Retrieved from https://www.ema.europa.eu/en/documents/regulatory-procedural-guideline/directive-2001/83/ec-european-parliament-council-6-november-2001-community-code-relating-medicinal-products-human-use_en.pdf

Eurostat, 2020. 53% of EU citizens sought health information online, Retrieved from https://ec.europa.eu/-eurostat/web/products-eurostat-news/-/ddn-20200327-1

Figueiras, A. R. D. P., 2016. How to tell stories using visualization: strategies towards Narrative Visualization.

Frascara, J., 1988. Graphic design: Fine art or social science?, Design issues, 5(1), 18-29.

Frascara, J., 2004. Communication design. Principles, methods, and practice, Allworth Press.

Frascara, J., 2015. What is information design, In J. Frascara (Ed.), Information design as principled action. Making information accessible, relevant, understandable, and usable (pp. 5–55), Champain, Illinois, USA: Common Ground Publishing

Grefé, R., 2011. Experience design is the only design, Design Management Review, 22(4), 26–30.

Heeter, C., 2000. Interactivity in the context of designed experiences, Journal of interactive advertising, 1(1), 3-14.

Hollis, R., 1997. Graphic design: a concise history, Thames and Hudson, London

Höök, K., & Löwgren, J., 2021. Characterizing Interaction Design by Its Ideals: A Discipline in Transition, She Ji: The Journal of Design, Economics, and Innovation, 7(1), 24-40.

Horn, R. E., 2000. Jacobson, R. (Eds.), 2000, Information design. MIT press.

Icograda Design Education Manifesto, 2011. Retrieved from http://www.icograda.org/education/manifesto.htm

IIID, 2007. IdX Core Competencies: what information designers know and can do. Retrieved from https://www.iiid.net/PublicLibrary/idX-Core-Competencies-What-information-designers-know-and-can-do.pdf

Kolko, J., 2010. Thoughts on interaction design, Morgan Kaufmann.

Martin, B., & Hanington, B., 2012. Universal methods of design: 100 ways to research complex problems, develop innovative ideas, and design effective solutions.

Moggridge, B., & Atkinson, B., 2007. Designing interactions (Vol. 17), Cambridge, MA: MIT press.

Neves, M., 2020. A Practice-Based Research Model for Interaction in Print Design, In Perspective on Design (pp. 175-187). Springer, Cham.

Phalke, V. D., Phalke, D. B., & Durgawale, P. M., 2006. Self-medication practices in rural Maharashtra, Indian journal of community medicine, 31(1), 34

Rodgers, Y., Sharp, H., & Preece, J., 2011. Interaction design: Beyond human-computer interaction, Wiley
Saffer, D., 2010. Designing for interaction: creating innovative applications and devices, New Riders.
Sanders, E. B.-N., & Stappers, P. J., 2008. Co-creation and the new landscapes of design, CoDesign: International Journal of CoCreation in Design and the Arts, 4(1), 5–18.
Schwab, K., 2015, December 12. The fourth industrial revolution: What it means and how to respond, Foreign Affairs.
Stickdorn, M., Hormess, M. E., Lawrence, A., & Schneider, J., 2018. This is service design doing: applying service design thinking in the real world, O'Reilly Media, Inc.
Tufte, E. R., 1990. Envisioning Information, Graphic Press.
Waarde, K. & Spinillo, C., 2015. The development of visual information about medicines in Europe, In J. Frascara (Ed.), Information design as principled action, Making information accessible, relevant, understandable, and usable (pp. 185-189), Champain, Illinois, USA: Common Ground Publishing.
Wiberg, M., 2018. The materiality of interaction: Notes on the materials of interaction design, MIT press.
Wildbur, P., & Burke, M., 1998. Information graphics: innovative solutions in contemporary design, London: Thames and Hudson.
World Health Organization, 2000. Guidelines for the Regulatory Assessment of Medicinal Products for Use in Self-Medication, Retrieved from https://apps.who.int/iris/bitstream/handle/10665/66154/WHO_EDM_QSM_00.1_eng.pdf
The World Counts. (n.d.). Paper Waste Facts. Retrieved July 30, 2021, Retrieved from https://www.theworldcounts.com/stories/Paper-Waste-Facts
Zimmerman, J., Forlizzi, J., & Evenson, S., 2007. Research through design as a method for interaction design research in HCI, In Proceedings of the SIGCHI conference on Human factors in computing systems (pp. 493-502)

Gamification for sustainable consumption

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Abstract

Plastic waste has become a major issue to our environment, tons of different types of plastic are discarded every year, especially the ones used in packaging. In this paper, the concepts of gamification and smart technologies are brought into a nature-centred approach that seeks to motivate and stimulate a more sustainable consumption behaviour. By optimizing the context in smart stores, a system for a sustainable consumption guide was developed to enhance new shopping experiences. We adopted methods used in user research as personas; behavioural assessment; sketches; prototypes and, simulation tools; and interviews with potential users' using the Self-Assessment Manikin (SAM). Iteration was in place throughout the conception process of the system to justify the design choices through the several cycles of development.

Keywords: sustainable consumption; smart store; gamification; augmented reality, nature-centred design

1. Introduction

In 2019, 368 million tons of plastic were produced worldwide (PlasticsEurope, 2020). The production of plastic started in the 1950s, and now it seems impossible to think about a planet without it (UN Environment Report, 2018). These polymers are not easily discarded, and their end-of-cycle comes down to three different destinations: landfills, recycling, and energy recovery (PlasticsEurope, 2020). "Researchers estimate that more than 8.3 billion tons of plastic have been produced since the early 1950s. About 60% of that plastic has ended up in either a landfill or the natural environment" (UN Environment Report, 2018). Although recycling processes have evolved worldwide, they are not enough to deal with massive production, especially single-use plastics found in packaging (PlasticsEurope, 2020). The main producers are to blame for such practices, but if consumers boycott these products, they can force these corporations to adapt.

In 2015, the United Nations [UN] introduced the Sustainable Development Goals [SDG] that intend to achieve "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 1987, p. 43). The SDG translate the urgency of mitigating the impacts of human activity on the environment. With this study, we expect to contribute to the SDG 12 (United Nations, n/d) which regards ensuring sustainable consumption and production patterns, to substantially reduce waste generation through prevention, reduction, recycling, and reuse (SDG 12.2). Additionally, to encourage companies, especially large and transnational companies, to adopt sustainable practices and integrate sustainability information into their reporting cycle (SDG 12.6). By 2030, the UN intends to ensure all the objectives and that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature (SDG 12.8).

To tackle plastic waste, better inform consumers, and contribute to the SDGs, we created an application [app.] to be used while grocery shopping. It will elucidate the impact of buying habits on the environment. The app. provides users with relevant information about manufacturers and packaging materials, for example. The app. utilizes gamification concepts to entertain users while stimulating them to make more conscious buying decisions based on a nature-centred design approach.

2. Theoretical background

2.1 Plastic waste

Almost 40% of the plastic produced in 2019 was destined for packaging (Beeco, 2021). The European Union [EU] has acted against plastic consumption by implementing new laws especially concerning plastic bag usage (European Commission, 2020). It is estimated that 1.5 billion of them are sold in supermarkets worldwide (Greenpeace, 2019). Moreover, according to Greenpeace (2019), roughly 58 billion units of plastic packaging were produced in 2018. Efforts are being made to suppress this uncontrolled source of waste, and consumers have become more alert to these issues (First Insight, 2020), but supermarket chains are not doing enough (Environmental Investigation Agency & Greenpeace, 2021).

2.2 Nature-Centred Design

Nature-centred design puts natured entities in the centre of processes and uses design research tools to achieve remedial interventions in nature (Tarazi et al., 2019). Similarly, environmental-centred design is an approach to product or service development that aims to make products or services environmentally, socially, and economically sustainable by focusing on the needs, limitations and preferences of the target human audience and non-human strategic stakeholders (Sznel, 2020). Nature-centred design involves knowledge and design techniques developed at the intersection of human-centred design, usability, ecology, and sustainability science (Tarazi et al. 2019). For this study, we adopted the term nature-centred design.

We could say that designers have mastered the ways of user-centred design, for which the focus is usability and user experience (Marti & Bannon, 2009). However, we are currently in a situation where it is necessary to redirect this knowledge to stimulate a more sustainable behaviour in individuals. Design has been at the forefront of some of the most innovative ways to improve sustainability introducing terms such as "eco-design," "green-design," or "environmental design" something that Thorpe (2007) denominated the first phase of sustainable design. These initiatives have focused on energy and materials. However, the author calls attention that the second phase requires an additional exploration of the role of design in the economic and social aspects of sustainability. Design strategies that help us meet needs with fewer purchased solutions could lead to more sustainable consumption (Thorpe, 2010).

Designers have introduced new concepts and focuses into their practice. Yet, there are new ways to guide users to further contribute to sustainable development. This usually happens when products are conceived to influence behaviour and not only to be more convenient or user-friendly (Wever et al., 2008). By creating such products there is space for new opportunities to explore existing data from user-centred studies regarding motivations, needs, and frustrations to drive more sustainable practices. The methods used in the usual practice of user-centred design are relevant to nature-centred design.

Companies are not solely responsible for this change; consumers also need to be motivated to join. This idea stems from the concept of Corporate Social Responsibility [CRS] where "business and society are interwoven rather than distinct entities; therefore, society has certain expectations for appropriate business behaviour and outcomes" (Wood, 1991, p. 695). It is necessary to also contemplate consumers' consumption behaviours and habits (Bhamra et al., 2011, p. 430).

2.3 Gamification

Gamification is associated with gamifying interactions. Although the concept has been an important and useful tool for designers to implement in interactive projects, users' motivations for engagement are mainly extrinsic, via badges or achievements to collect and share. Lawley (2012) clarifies that it is not enough to force gamification into an application with these sorts of extrinsic motivations to get users invested or focused. This means that implementing gamification cannot be the last resort to bring or keep users interested. Many gamification-based solutions fail because, mostly, they have been created without a clear and formal design process (Mora et al., 2015). These forced experiences can generate negative consumer impact instead of increased engagement (Lucassen & Jansen, 2014). This suggests that an unexpected element of the interaction is not

necessarily acknowledged by users as a "game element". Besides, if it is presented as an intrusive mechanism in the process it tends to disturb the overall user experience (Lucassen & Jansen, 2014).

To Paharia (2012) it is imperative that the element being gamified has an intrinsic value, a reason for users to engage with, adding gamification to uninteresting content will not help. The direct connection between gamification and the retail usually lies in granting costumers with discounts (Paharia, 2012). If these concepts are successfully implemented customers might not realize they are "playing" a game but believe they have been introduced into a segment of an experience. In this way, the behavioural change is much more friendly and impactful given that users are naturally interacting rather than being forced to. Additionally, user-centred design practices are essential; knowing customers' motivations and needs must be considered throughout the gamification process.

2.4 Smart Stores and Gamification

Smart stores are defined as ones using smart technology, such as radio frequency identification (RFID), and smart shelves, scales, carts, and cards (SmartStores.com, 2008). Shoppers can buy products by placing them into a shopping cart and leaving without having to go through a cashier (SmartStores.com, 2008).

Online shopping has improved the commodity of shopping, consumers can buy goods from the comfort of their homes. This means that physical retailers must compete with other brands and with online channels (Bourg et al., 2012). However, integrating ICT (information and communication technology) services into offline experiences provide customers with part of what online channels have to offer. In this way, they undergo a similar process to e-shopping, by accessing information about products, while still maintaining the in-store experience. Concerning smart stores capabilities, Hwangbo (2017, p.1) explains: "Recently, companies and researchers have paid attention to technologies, such as sensors, indoor positioning, augmented reality, vision, and interactive interfaces, which helped offline retail shops to improve their service quality". This is undeniably an area of expertise in which interaction designers may have a significant impact, as creativity has had a big influence in shaping the contemporary retail paradigm (Kent, 2007).

User-centred design is a part of this discussion as it is necessary to carefully consider the customer experience in this new retail scenario, but with the purpose of producing a more sustainable behaviour (Wever, 2008). As much as users might want to save time and money while shopping, prioritizing sustainable behaviour may contribute considerably to solving the environmental crisis in the future. Gamification can make a difference in this context, this concept has already expanded into the service and retail fields and should also accompany the evolution of smart stores (Lucassen & Jansen, 2014). Following the increasing concern about sustainable shopping (First Insight, 2020) it is reasonable to use gamification to develop an interactive system that prioritizes sustainable behaviour while rewarding users (Mekler et al., 2015).

The availability of smart technology creates an opportunity to implement Augmented Reality (AR) tools to complement the retail experience. AR is defined as a real-time direct or indirect view of a physical real-world environment enhanced/augmented by adding virtual computer-generated information (Carmigniani et al., 2010). The idea of coexistence between the digital and the real world (Azuma, 1997) creates possibilities for innovation. For instance, in medical contexts, utilizing existing sensors for CT scans and ultrasound, patients could see "inside" their bodies to better understand their health (Azuma, 1997). More recently, AR has proved to be a valuable tool in education in interacting with learning opportunities, especially when it comes to books, becoming an enhanced version of a traditional "pop-up" book". (Billinghurst, 2002). Additionally, in e-commerce and marketing, AR greatly enriches consumer experience by product simulations, bringing innovation and attracting new customer (Carmigniani et al., 2010; Poushneh & Vasquez-Parraga, 2016).

3. Methodology

To collect the most relevant information on users and later create personas, we constructed an online questionnaire, used the information to construct personas. The next step was to create the app.'s interface using sketches and prototyping. Finally, the built prototypes were tested with potential users to test.

3.1 Questionnaire

The information about potential users' motivations, needs, and frustrations was collected through an online questionnaire composed of four parts: an introduction; closed-ended questions (shopping frequency and type of establishment; open-ended questions (main frustrations when shopping, sustainable habits, and top-of-mind innovative sustainable products), and the demographic questions (Annex 1). It was available from March to April 2021.

Based on Hill (1998), we established that the study needed at least 30 answers to have some grounding and there were 38 responses, which was according to that estimate. From the respondents 26,3% were men and 73,7% women. The ages varied from 18 – 38, the mean age was 23 years and were mostly college students (82%) (Figures 1-3).

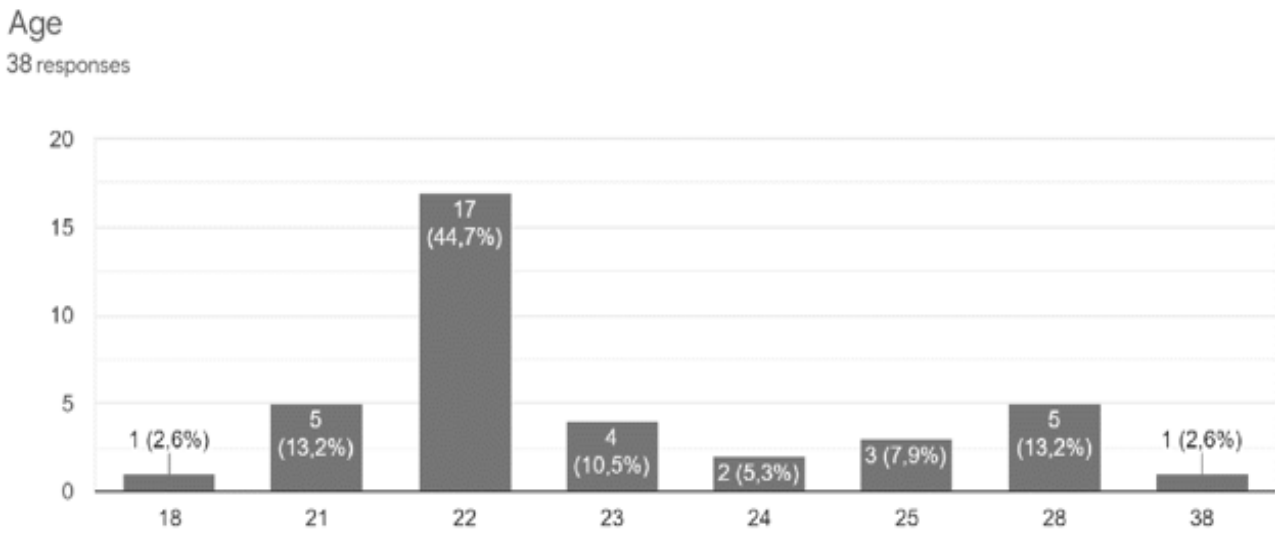

Figure 1. Interviewee's ages (%). Source: Authors.

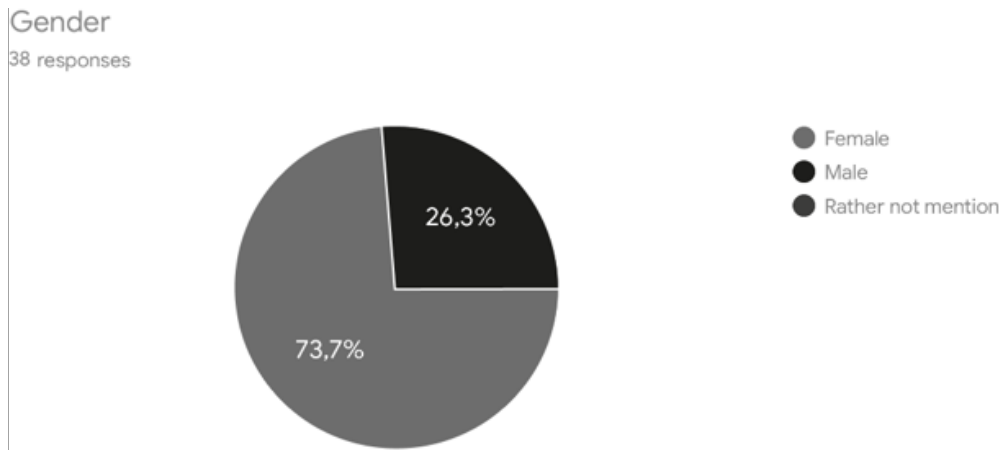

Figure 2. Interviewees' gender distribution. Source: Authors.

The answers to the questions regarding the needs and frustrations was divided into two groups:
Group A: individuals concerned about time inefficiency while shopping. Waiting in line to pay and the self-checkout machines were among their complaints. Most of them were male respondents, over 22 years (26%).

Group B: respondents who expressed their difficulty to locate the sustainable products in supermarkets and mentioned that these products are more expensive. They were more against using plasticized products and had some idea regarding innovative and alternative products.

From the characteristics of Groups A and B, we created two personas: Ricardo, 27 years old (Fig. 4) whose major concern is to go shopping as quickly and conveniently as possible, and Raquel, 22 years old (Fig. 5), worried about the environment.

3.2 Project Definition
To include the nature-centred concept into our project we decided to develop a sustainable consumption guide whose objective is to inform users of the consequences of their shopping habits. The guide not only suggests "greener" products but gives examples of the impact of more sustainable choices on the environment. An effort was also made to comprise the motivations of both personas. Group B sees grocery shopping as time consuming. So, to shorten the time taken supermarkets, we included a map to indicate the location of the products on users' shopping lists. The functionalities will be further explained in section 2.3. of this paper.

The gamification component of the app. is composed of a scoring system related to the users' product choices. Each product is given a sustainability score regarding its material, origin, distribution process, composition, packaging and so on. Groups of users compete with others based on their scores from recent shopping trips. Each group receives an overall score, calculated from the average of all the participants. Including this mechanism into the system strengthens the gamification concept, improves group motivation, and aims to promote individual betterment. The real reward is the activity not the achievement itself (Lawley, 2021).

The next step was to decide the interface. After considering options like tablets, smart glasses, and smart watches we concluded that the most convenient device would be a smartphone due to its popularity of use.

3.3 Functionalities
The app. was designed to have the following functionalities:

Home: the main menu, users can access the relevant functions before starting their shopping trip, like shopping lists, groups, and receipts.

Shopping list: create and name different lists and add products to them accordingly. Users can also access, edit, or delete any previous shopping lists. In this way, they would not have to start a new list every time they go shopping. The products are displayed by type rather than by brand or quantity of a specific item, the system suggests sustainable options.

Groups: customers can form groups with friends, family, colleagues to compare and improve their sustainable consumption scores.

Store map: map of the supermarket based on the products on the shopping list. It is possible to find the products' locations and trace a map of the aisles, guiding the customer through an optimized route (product-wise). The purpose is to provide the users with a map to sustainable products eliciting a more conscious consumption.

Sustainability heatmap: in-shop AR experience. Each product is highlighted according to its sustainability score. Inspired by heatmaps, it indicates how sustainable a product is by colour.

Green Receipt: is a visual proof of users' more sustainable choices. It is composed of a list of the purchased items and their score depending on how sustainable they are, and the amount of time saved for our planet. Users receive a mean score for the whole of the shopping trip. For each product there is a short explanation to demonstrate the opportunities for a more sustainable purchase.

RICARDO, 27

"The problem is not the plastic, but the the way we use it and waste it."

Hi! My name is Ricardo, I live in Lisbon where I study Engineering Informatics in Faculdade de Ciências. Me and my childhood friend share a home and we usually alternate between us for who gets to go shopping. I like to go to the furthest supermarket as there are more tills, this way I don't lose as much time and come back home quickly. I carry my reusable plastic bag and I think that's a good enough effort to reduce the plastic waste in the oceans. I'm doing my part!

I am

Introvert — Extrovert

Think — Feel

Judge — Understand

I buy

Context of Use

Another day of shopping! I ask my roommate to use his car, as our families are visiting, but I need to hurry, they're almost here. As I arrive to the supermarket I open my app and my list is already saved there, I already know it will guide me through all the process. As I've gone through the list, my shopping cart is full and I go through the tills without having to stay in line. I'm done shopping in half the time as I normally would!

I want to

- A void lines
- Find the products I want
- Apply discounts and promotions

I hate

- When the self-checkout machine isn't working
- Lines that take too long
- When products change locations

Figure 4. Persona 1. Source: Authors

RAQUEL, 22

Plastic is the problem."

Hello, I'm Raquel, come from the center of Portugal, and I'm studying Journalism in Lusófona University, in Lisbon. Currently living by myself in a rented room, I need to try and save money in any way I can. I usually shop in a market close to home and I already know some of the salesmen, as they tend to learn what I'm looking for and there's never a hassle. When I need more specific products, hypermarkets are the only places that have them, although most of their products are not environmently-friendly. Not only I struggle to find the products I'm looking for, but they are also expensive, compared to their "normal" alternatives.

I am

Introvert — Extrovert

Think — Feel

Judge — Understand

I buy

Context of Use

Altough I'm not a fan, this time I need to go shopping at a big supermarket chain. I'm looking for specific items not usually found in local groceries. As I'm not an experience costumer here, I look for a device that guides me in the products' location while at the same type leading me to greener alternatives. As I'm shopping I have the confidence that I'm consuming products that put the planet's health on the same level as me!

I want to

- Avoid plastics
- Find bulk products
- Buy products that won't harm the planet

I hate

- When I have to plastify fruit and vegetables
- When there's not alternative to plastic containers
- That the sustainable products are the most expensive

Figure 5. Persona 2. Source: Authors.

Figure 6. App functionalities. Source: Authors.

Figure 7. Logo Studies. Source: Authors.

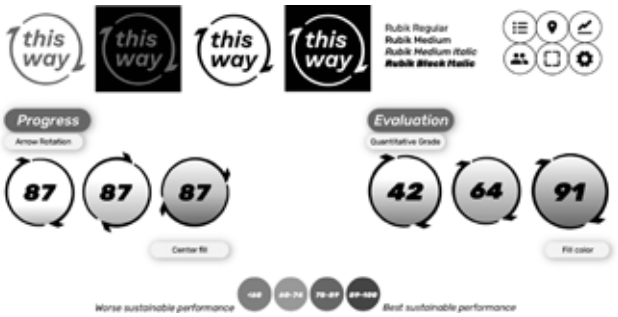

Figure 8. Final brand components. Source: Authors.

Totem: it is an external item of the app. It replicates the results on the receipts so give them more visibility, placed at the exit displaying score of a shopping trip.

3.4 Sketching

In this step all the main interfaces of the app were defined: the homepage, the AR, and the also the navigation. Below we describe each of these components.

Homepage: The homepage is composed of two sections: home and shopping. In the home section users can choose among 4 options (saved shopping list, group, shopping history, settings) and in the shopping sections there are also 4 options (new shopping list, shopping map, AR aisle and report) (Figure 4).

Augmented reality: The biggest challenge in this phase was how to design the Augmented Reality interface and the report section. Two options were created and tested to verify users' preference.

Brand: To create the logo we carried out a study of possible names to represent the sustainable consumption guide. The starting point was based on the statement "this is the way for sustainable consumption". « That statement was shortened to "This Way" related to: "This is the way to change

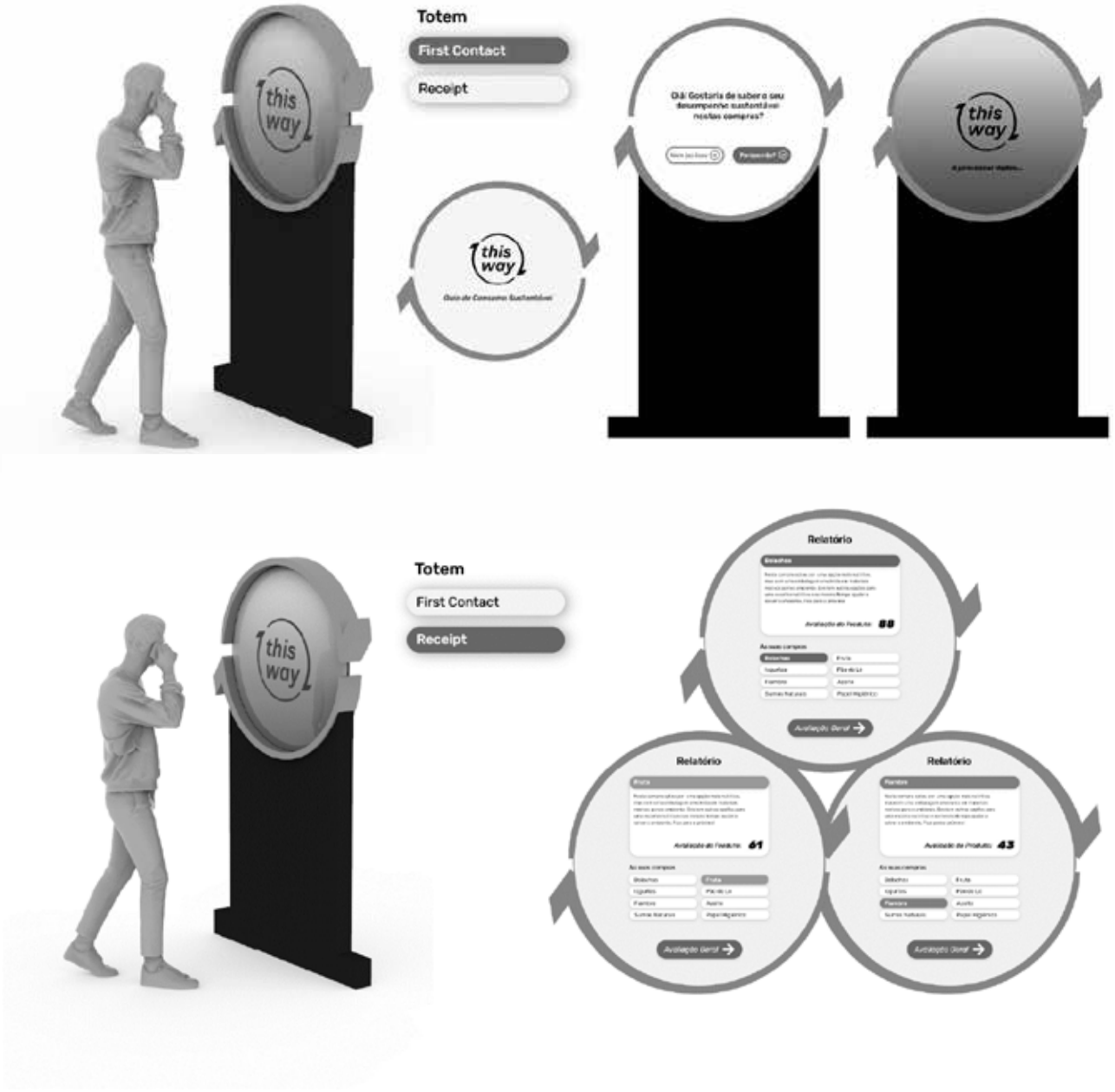

Figure 9. Totem. Source: Authors.

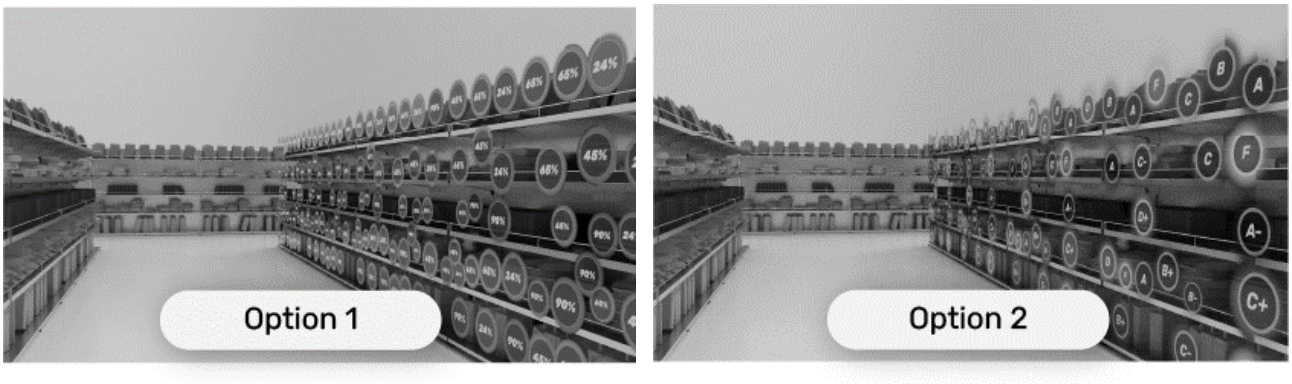

Figure 10. AR Option 1 (left) and Option 2 (right). Source: Authors.

the world" and "This is the way to turn back the clock". "This way" can also relate to someone giving direct instructions, which also expresses the idea of education and information. Figure 5 shows the logo studies and Figure 6 the final brand components.

Totem: the design of the totem was originated from the brand logo, it is composed by a central screen that resembles a lens, and a support for implementation of the digital system.

3.4 Prototyping

The prototyping phase was divided into two moments: constructing the high-fidelity prototype and designing the AR in-store experience.

High fidelity prototyping:

Prototyping began with a low to mid fidelity version using Adobe XD to start organizing the interface and navigation system.

One objective for this stage was also to include real-time feedback, representing the progress and evaluation of the users' shopping trips. This not only improves the overall user experience but also incorporates de gamification component into the system. Most of the design choices were based on Nielsen's (1994, p.153) Usability Heuristics while respecting the brand expression.

Prototyping also enabled a better understanding and improvement of the user flow while interacting with the application, improving navigation.

AR in-store experience simulator:

To initiate the design and evaluation of AR in-store experience, we needed a narrative that would guide. For this we simulated a product search at a supermarket where the users were able to experience AR on a smartphone through a 30-second video. However, a rendered 3D software improved both realism and quality of the image. Using a 3D modelling software (Rhinoceros 6.0), and open-sourced supermarket shelves in .STL, the aisles layout and the different layers for each product defined.

Since the rendering aspect was crucial for better results of the evaluation stage, Keyshot 9.0 software was chosen to mimic materials for each 3D element and run test renders. This offers the designer an approximate estimate of the rendering quality and the required time for a full animated render.

After completing the 3D environment, we started developing the AR interface of the in-store experience. Two options for the interface were developed to be tested, they were composed by the products' sustainability score, represented by both colour and quality.

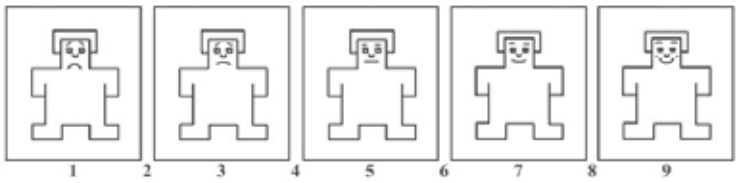

Figure 11. SAM Scale. Source: Bradley & Lang, 1994.

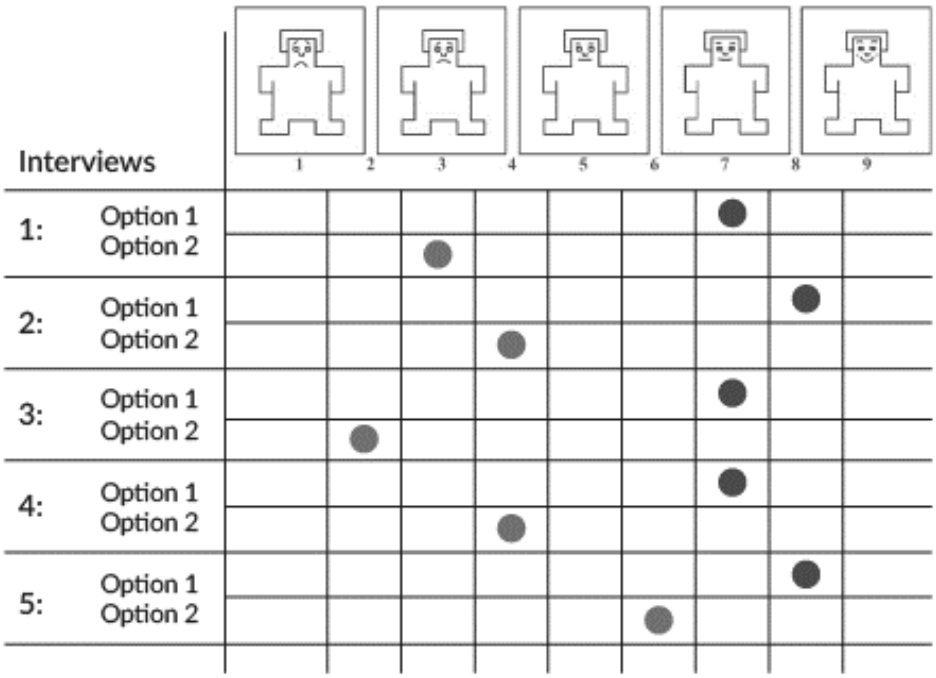

Table 1. Results of the AR Evaluation. Source: Authors.

The first option used a number categorization, from 0% to 100%, where 0% is the least sustainable and 100% is the most and primary colours (from red to dark green) in the background. Whereas the second option used an alphabetical categorization (where A is the most sustainable, to F the least sustainable) and using different tones of green.

3.6 Evaluation

To evaluate the two AR layout options and the motivations of users to use the app. we carried out a set of interviews. To obtain users' assessment we chose to apply the Self-Assessment Manikin scale [SAM] (Bradley & Lang, 1994). The SAM scale consists of 5 humanoid representations, each one represents a different emotion, and a numeric scale from 1 to 9 (unhappy to happy) (Figure 7). The interviews (Annex 2) started with a brief introduction about the project, then simulation videos of the two AR options were shown to the participants. After each video, the interviewees were asked to select an option on the SAM scale. A pilot interview took place to identify possible adjustments. After the pilot, we made the necessary modifications to the script. We conducted 5 interviews, our sample was composed of four men and one woman, aged between 21 and 26 years. All the interviews were conducted via videoconference. The AR simulation videos, and the SAM scale were shared using the "screen share" tool, and the interviews were recorded for future reference.

Applying the scale allowed us to compare and improve the simulations presented to the users. From the results, it was clear that the users preferred AR Option 2 (Table 1), it gave users a better perception that the products were being evaluated. For the remaining questions about motivation to use the app., users considered the context as the main condition for adopting it. On one hand, 4 out of 5 respondents expressed that in a long shopping trip (<30 minutes), the application would be very useful. On the other hand, short shopping trips were not considered the best context of use, as it was seen as more of a distraction and might slow down the customers.

4. Discussion

This project adopted iterative design processes, in the early stages, users were interviewed to construct personas and then to support the prototyping design decisions. Finally, they evaluated the high-fidelity prototype. Iteration allows for designs to be refined, to revise ideas considering users' feedback (Preece et al., 2015). The final version of the prototype contemplated the results of the evaluation phase, it was a combination of Options 1 and 2. This choice enabled us to incorporate the scoring concept into all the functionalities so users have access throughout the experience. Working with users (and for users) in different phases helps designers to support their decisions throughout the process, especially regarding interaction features that deal with behavioural matters (Wynn, 2016).

One issue to be addressed is to make the in-shop experience less intrusive, respecting users' usual behaviour while shopping. For a product or a system to have good usability, it must consider the context of use (ISO, 2010). For designers to develop interactions such as this, there needs to be extra attention to the users' original context of use. Usability deals with the suitability between the product and the intended tasks, the suitability with the user who will use it, and the adequacy to the context in which it will be used (Moraes, 2013, p.7).

Additionally, implementing the app. could present a few challenges as obtaining the collaboration of supermarkets, producers, and distributors. Their participation is paramount to collect the necessary product information for determining the scores.

Adopting a nature-centred concept supports the idea that sustainability prioritizes context over the object. An approach to design that is "ecologically responsible and socially responsive" (Papanek, 1984, p. 346). Papanek (1984) harshly criticizes industrial design that responds only to the demands of consumer culture and calls designers to their responsibility for their creations. Designing for sustainability is designing against consumerism, in a context where most design is for consumerism, promoting sustainability is a huge challenge (Micklethwaite, 2019).

5. Conclusions

Managing the focus and concepts approached in the theoretical background proved to be a challenge, as there were some constraints in of trying to achieve a usable product, but also be innovative and promote sustainable behaviour. This is mostly due to the usability premises of knowledgeability, given that customers are used to having certain interactions with a smartphone app. Gamification is usually thought to only offer rewards such as achievements badges, and discounts, but the process of introducing intrinsic values to this application had to be relevant.

The extent of the behavioural change and bigger scale implications on nature must be tested with a large sample of users to provide empirical prove. The accessibility of information through this channel is one of the many opportunities surrounding this area of development.

The iteration process had the most impactful influence on the outcome of the final product. The many versions created permitted us to continuously evolve. This made for a much more enjoyable design experience, motivating the team to proceed. What began with a smartphone app. evolved into a whole experience around sustainable consumption, because of the iterations.

Moreover, systems that contribute to fighting against waste, enhancing, and stimulating a more sustainable consumption are increasingly necessary if we intend to achieve any of the SDGs or climate-neutral projects. Companies and consumers alike, are responsible for making the change happen and we believe designers have the utmost possibility to influence those actions and must continue to be the providers of sustainable changes.

Limitations & future work

For future work it would be ideal to increase the sample size of potential users to reduce the error margin and enable the implementation of the project (Hill, 1998). Also, the product was tested with a homogeneous sample, mostly university students, to really understand the possible issues it is necessary to test with individuals of different backgrounds and age groups.

Conflict of Interests

The authors declare that there is no conflict of interest.

Acknowledgements

This work was supported by Fundação para a Ciência e Tecnologia (2020.04596.BD).

References

Azuma, R. T. (1997). A Survey of Augmented Reality. Presence: Teleoperators and Virtual Environments, 6(4), pp. 355–385. https://doi.org/10.1162/pres.1997.6.4.355

Beeco. (2021). Impact of Plastic Packaging in Supermarkets in the UK. Retrieved from: https://www.beeco.green/blog/plastic-packaging-supermarket/

Billinghurst, M. (2002). Augmented Reality in Education. 5.

Bhamra, T., Lilley, D., & Tang, T. (2011). Design for Sustainable Behaviour: Using Products to Change Consumer Behaviour. The Design Journal, 14(4), pp. 427–445. https://doi.org/10.2752/175630611X13091688930453

Bradley, M. M., & Lang, P. J. (1994). Measuring emotion: The self-assessment manikin and the semantic differential. Journal of Behavior Therapy and Experimental Psychiatry, 25(1), pp. 49–59. https://doi.org/10.1016/0005-7916(94)90063-9

Carmigniani, J., Furht, B., Anisetti, M., Ceravolo, P., Damiani, E., & Ivkovic, M. (2011). Augmented reality technologies, systems and applications. Multimedia Tools and Applications, 51(1), pp. 341–377. https://doi.org/10.1007/s11042-010-0660-6

Deterding, S. (2012). Gamification: Designing for motivation. Interactions, 19(4), pp. 14–17. https://doi.org/10.1145/2212877.2212883

Environmental Investigation Agency & Greenpeace. (2021) Checking out on Plastics III. Retrieved from https://checkingoutonplastics.org/

European Commission. (2020) Committing to climate-neutrality by 2050: Commission proposes European Climate Law and consults on the European Climate Pact. Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/ip_20_335

First Insight. (2020). The state of consumer spending: Gen Z Shoppers Demand Sustainable Retail. Retrieved from: https://cdn2.hubspot.net/hubfs/160569/1.14.2020%20The%20State%20of%20Consumer%20Spending%20Gen%20Z%20Shoppers%20Demand%20Sustainable%20Retail.pdf

Green Atkins, K., & Kim, Y. (2012). Smart shopping: Conceptualization and measurement. International Journal of Retail & Distribution Management, 40(5), pp. 360–375. https://doi.org/10.1108/09590551211222349

Greenpeace. (2019). Supermarkets putting more plastic on their shelves than ever. Retrieved from https://www.greenpeace.org.uk/news/supermarkets-more-plastic-than-ever

Hill, D. R. (1998). WHAT SAMPLE SIZE is 'ENOUGH' in INTERNET. 6(3), 10.

Hwangbo, H., Kim, Y. S., & Cha, K. J. (2017). Use of the Smart Store for Persuasive Marketing and Immersive Customer Experiences: A Case Study of Korean Apparel Enterprise. Mobile Information Systems, 2017, pp. 1–17. https://doi.org/10.1155/2017/4738340

ISO (International Standard Organization). (2010). ISO 9241-210:210. Ergonomics of human-system interaction-Part 210: human-centered design for interactive systems. Genebra: International Standard Organization.

Kent, T. (2007). Creative space: Design and the retail environment. International Journal of Retail & Distribution Management, 35(9), pp. 734–745. https://doi.org/10.1108/09590550710773273

Lawley, E. (2012). Games as an Alternate Lens for Design. In: Deterding, Sebastian. 2012. 'Gamification: Designing for Motivation'. Interactions 19(4): pp. 14–17. doi: 10.1145/2212877.2212883.

Lucassen, G., & Jansen, S. (2014). Gamification in Consumer Marketing—Future or Fallacy? Procedia - Social and Behavioral Sciences, 148, pp. 194–202. https://doi.org/10.1016/j.sbspro.2014.07.034

Marti, P., & Bannon, L. J. (2009). Exploring User-Centred Design in Practice: Some Caveats. Knowledge, Technology & Policy, 22(1), pp. 7–15. https://doi.org/10.1007/s12130-009-9062-3

Mekler, E. D., Brühlmann, F., Tuch, A. N., & Opwis, K. (2017). Towards understanding the effects of individual gamification elements on intrinsic motivation and performance. Computers in Human Behavior, 71, pp. 525–534. https://doi.org/10.1016/j.chb.2015.08.048

Micklethwaite, P. (2019). Design Against Consumerism. In A. Massey (Ed.), A Companion to Contemporary Design since 1945, pp. 436–456. John Wiley & Sons, Inc. https://doi.org/10.1002/9781119112297.ch21

Mora, A., Riera, D., Gonzalez, C., & Arnedo-Moreno, J. (2015). A Literature Review of Gamification Design Frameworks. 2015 7th International Conference on Games and Virtual Worlds for Serious Applications (VS-Games), pp. 1–8. https://doi.org/10.1109/VS-GAMES.2015.7295760

Moraes, A. (2013). Ergonomia, ergodesign e usabilidade: algumas histórias, precursores: divergências e convergências. Ergodesign e HCI, 1(1), pp. 1–9.

Nielsen, J. (1994). 'Enhancing the Explanatory Power of Usability Heuristics' https://doi.org/10.1145/191666.191729

Nielsen, J. (1994). '10 Usability Heuristics for User Interface Design'. Retrieved from https://www.nngroup.com/articles/ten-usability-heuristics/

Nielsen, J. (2000). Why You Only Need to Test with 5 Users (nngroup.com)

Nielsen, J., & Landauer, T. K. (1993). A mathematical model of the finding of usability problems. Proceedings of ACM INTERCHI'93 Conference (Amsterdam, The Netherlands, 24-29 April 1993), pp. 206-213.

Norman, Donald A. (2013). The Design of Everyday Things. Revised and expanded edition. New York: Basic Books.

Paharia, R. (2012). Gaming Means Amplifying Intrinsic Value. In: Deterding, Sebastian. 2012. 'Gamification: Designing for Motivation'. Interactions 19(4): pp. 14–17. doi: 10.1145/2212877.2212883.

Papanek, V., (1984). Design for the real world: Human Ecology and Social Change. 2nd ed. London: Thames & Hudson.
Preece, J.; Rogers, Y.; Sharp, H. (2015). Interaction design: beyond human-computer interaction. 4th ed. West Sussex: John Wileys & Sons

Preece, J., Rogers, Y., & Sharp, H. (2002). Interaction Design: Beyond Human-Computer Interaction. Retrieved from https://www.sharritt.com/CISHCIExam/preece.html

PlasticsEurope. (2020). 'Plastics – The Facts'. Retrieved from https://www.plasticseurope.org/en/resources/publications

Poushneh, A., & Vasquez-Parraga, A. Z. (2017). Discernible impact of augmented reality on retail customer's experience, satisfaction and willingness to buy. Journal of Retailing and Consumer Services, 34, pp. 229–234. https://doi.org/10.1016/j.jretconser.2016.10.005

SmartStores.com. (2008). What are Smart Stores? Retrieved from *https://smartstores.com/what-are-smartstores*

Sznel M. (2020) The time for Environment-Centered Design has come. Retrieved from: https://uxdesign.cc/the-time-for-environment-centered-design-has-come-770123c8cc61

Tarazi, E., Parnas, H., Lotan, O., Zoabi, M., Oren, A., Josef, N., & Shashar, N. (2019). Nature-Centered Design: How design can support science to explore ways to restore coral reefs. The Design Journal, 22(sup1), pp. 1619–1628. https://doi.org/10.1080/14606925.2019.1594995

Thorpe, A. (2007). The Designer's Atlas of Sustainability. 239.

Thorpe A. (2010). Design's Role in Sustainable Consumption. Des Issues. 2010;26(2). pp. 3–16. Available from: https://www.jstor.org/stable/20749938%0A

United Nations Environment Programme. (2018) Annual Report 2018. Retrieved from https://www.unep.org/annualreport/2018/

United Nations [UN]. (1987). United Nations General Assembly. Retrieved from https://sustainabledevelopment.un.org/content/documents/5839GSDR%202015_SD_concept_definiton_rev.pdf

United Nations [UN]. (2021). The Sustainable Development Goals Report. Retrieved from https://unstats.un.org/sdgs/report/2021/The-Sustainable-Development-Goals-Report-2021.pdf

United Nations. n/d. Sustainable Development Goals. Retrieved from https://sustainabledevelopment.un.org/sdgs

Wever, R., van Kuijk, J., & Boks, C. (2008). User-centred design for sustainable behaviour. International Journal of Sustainable Engineering, 1(1), pp. 9–20. https://doi.org/10.1080/19397030802166205

Wood, D. J. (1991). Corporate social performance revisited. Academy of Management Review 16, no. 4 (1991): pp. 691-718.

Wynn, D. C., & Eckert, C. M. (2017). Perspectives on iteration in design and development. Research in Engineering Design, 28(2), pp. 153–184. https://doi.org/10.1007/s00163-016-0226-3

The Digital Cell, an Analysis of the Digital Media Environment

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Abstract
Digital media, serving as the dominant cultural voice in our contemporary climate, has raised questions of truth; compositing techniques of computer-generated imagery have accelerated the era of post-truth; fluctuating digital images that unfold in source-independent simulations are accentuated by sensations and stimuli. The users of the digital media not only immerse themselves in digital culture but also participate in processes that highlight subjective experience. In an ever-expanding digital environment, how can design thinking function as a creative lens to review the interactive mechanisms of the human experience across digital media? To examine our consciousness in the age of interactive digital media, this essay creates a speculative design and a speculative narrative of how we came to have the montage-like perception. The Digital Cell, an interactive virtual design manifesting the concept of the montage-like perception, the work aims to configure a critical lens to evaluate our aesthetic and synthetic experience in the digital age.

Keywords
Digital media; interactive design; digital perception; design apparatus; speculative design.

1. Introduction

The Digital Cell is a speculative design created on a virtual interactive platform accessible as an avatar. The layout of the design consists of two rooms: 1–Nucleus, an inner spherical room; and 2–Cell, an outer spherical room of the Nucleus. The design uses biological terms to render surreal organic environments, alluding to the essential and complex relationships of digital conditions. The work is a visual manifestation of the concept, the montage-like perception, that overall reflects an inquiry to our aesthetic and synthetic experiences in digital media culture. Through a speculative narrative of how we came to have the montage-like perception, the work examines the relationship between our perception and the interactive mechanism of the media.

2. Nucleus

2.1. The Climate of the Post-Aura

The montage-like perception emerges from the contemporary climate of the post-aura. The first room, Nucleus, is a manifestation of that condition. Fully enclosed by the wall, nuclear membrane, this room reveals a fragmented view of the outside world through pores. As if Nam June Paik's M200/Video Wall was brought to life, the fragmented view creates montage-like countless scattered images.

Throughout history, the media have shaped the way we interact with and interpret images, and thus the way we interpret reality. The invention of film and photographic media opened up scientific awareness that introduced micro and macroscopic views of our world. This has extended our perceptual development to understand the reality seen through the lens. Today's media technology has introduced new forms of imagery and interactive systems that allow us to immerse ourselves in the screen beyond what we simply see through a lens. The more our sense of reality and perception evolve from media, the more it will continue to influence the interactive mechanisms of human experience across digital media.

Defined by Walter Benjamin, post-aura is "the desire of contemporary masses to bring things 'closer' spatially and humanly which is just as ardent as their bent toward overcoming the uniqueness of every reality by accepting its reproduction" (Benjamin, 1935) Remarked in the age of mechanical reproduction, the post-aura continues to this day

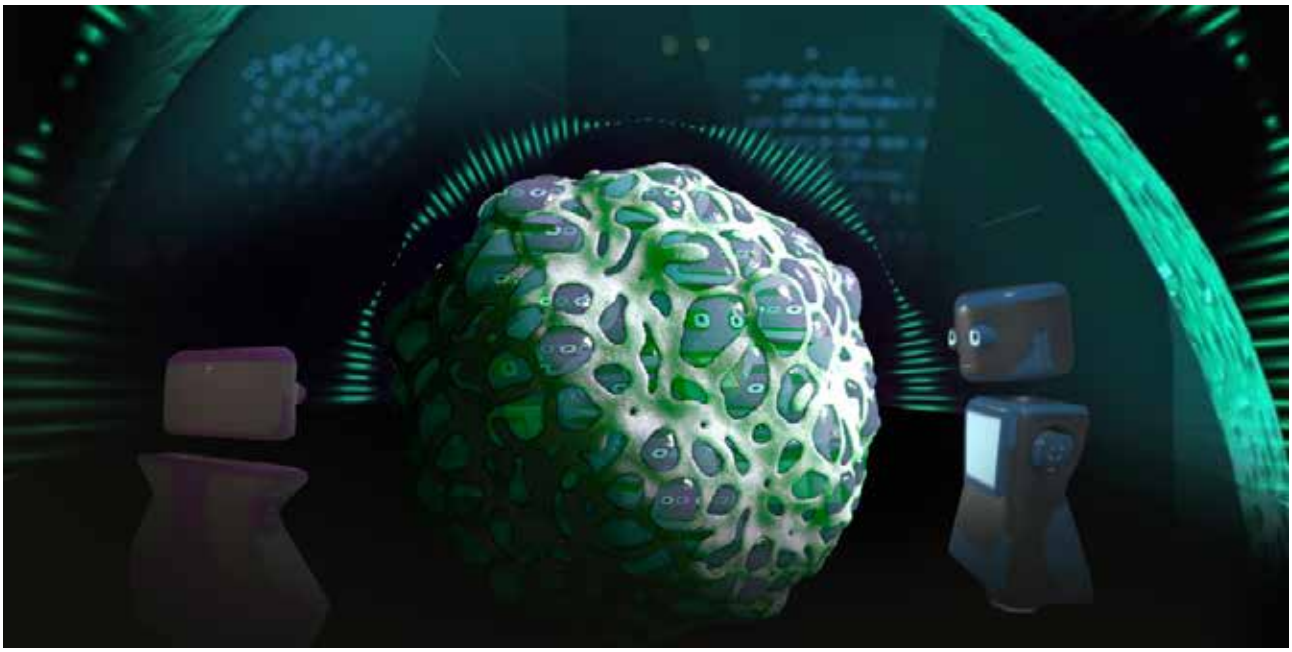

Figure 1. Prototype view of *The Digital Cell*, 2021. Mixed Media, Online.

not only in art but also in our daily experiences. The aura of concerts and art galleries is easily compressed into the way we possess it on our smartphone devices. The audience is physically 'close' to the aura, but such media interventions rather extend the distance to the aura by limiting our view to a smaller screen. Still, these screens are the active lenses that are prevalent today, vividly connecting and mediating reality.

This experience extends to a networked web of media platforms where members of the digital society interact and participate in the process of the post-aura reproduced in the form of mitosis. The high-speed information transmission technology of digital media has created an environment where the real-time world can be experienced up close and indirectly, and furthermore, perform instant sharing and participation in graphic and content creation. We see news turned into memes and digital artifacts, GIFs, and advertising algorithms constantly reappearing in the corners of social media screens. Compressed, converted, transmitted, and manipulated, information and images circulate in a diffuse and fluctuating digital space in the mode of source-independent simulation that inherits the patterns of the post-aura. In his treatise, The Society of the Spectacle, Guy Debord points out "Where the real world changes into simple images, the simple images become real beings and effective motivations of hypnotic behavior" (Debord, 1967) In other words, media and media-mediated images have a profound effect on us. The more we interact and participate in the means of the spectacle, the greater its impact on our perceptual development.

3. Cell

3.1. The Climate of the Post-Truth

The montage-like perception is therefore a device of post-aura and counter-post truth as a basis for creative and free interpretation of our reality. Manifested in the second room, Cell represents the post-truth world. The Cell is an outer spherical room that encapsulates the Nucleus. The Nucleus, located in the center of the room, becomes the stage for spectators. While the pores inside the nucleus were a lens to see the outside, the pores outside the nucleus are now transformed into a screen that recorded the avatar spectators. The virtual self is technologically mediated in a montage-like scattered view, and the avatar spectators see a fragmented image of themselves.

In the expansion and saturation of the digital environment, the creative leap of reading and the kaleidoscope mode of simulation is required for today's perceptual abilities. We are experiencing that interactive media and computer-generated images are accelerating the era of post-truth, blurring the lines between imagination and reality, and raising questions of authenticity. Likewise, source-independent simulations accentuated by sensations and stimuli further highlight subjective experiences. It shows that not only our experiences but also the character and expression of language change as the medium changes. Because our perception is expressed in language, the medium defines the range of expressions that affect our perception. For example, comparing the two different interactive mechanisms of media between one-way delivery channels such as newspapers and interactive channels such as social media and online platforms, the development of perceptual attitudes is recognized differently. On the contrary to causally ordered structures of newspapers, the interactive mechanisms of computer-based media allow less restrictive and nonlinear structural relationships of clickable, movable, reversible, and manipulable information.

3. Montage-like Perception

As we adapt to changes in digital media and its cultural artifacts, it creates a context for building perceptual awareness in confronting the technological and socio-cultural challenges of post-aura and post-truth: the montage-like perception. It is a perception that processes mechanical speed, overwhelming volume, fluctuations in graphics and information. Information units are refined into fragments and become the material for reconstructing the creative structure of reality. By then applying the nonlinear structure of the learned behavior of digital media, members of the digital society can perform their perceptual ability to freely deconstruct and reconstruct their understanding of reality.

4. Conclusion

In a time when units of information and media are unfolding into the complex mode of spectacle, recontextualizing technological experiences helps rethink current media conditions. By reflecting on how we build our perceptual relationships with media, it aspires to our role as users and creators, therefore, envisioning a new model of participation and a step towards the future of media.

Conflict of Interests

The authors declare no conflict of interests.

References

Benjamin, W. 1969. The Work of Art in the Age of Mechanical Reproduction. In: Illuminations, edited by Hannah Arendt, translated by Harry Zohn, from the 1935 essay. New York: Schocken Books.

Debord, G. 1994. The society of the spectacle. New York: Zone Books.

Paik, N. 1991. M200/Video Wall, multi-monitor, sculptural installation, https://www.jamescohan.com/exhibitions/nam-june-paik3?view=slider

Developing a Digital Application for Patient Medical History

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Abstract

The value of a patient-centered care (PCC) approach should be considered in the context of the Portuguese healthcare system, particularly because several structures are being used but not properly interlinked, to the detriment of the patient. The patient should be considered the most important element in the healthcare system, among other reasons because of the impact on the patient's treatment efficiency. This paper aims to encourage PCC by exploring ways to facilitate the exchange of medical records. A Research through Design (RtD) approach helped us define a possible strategy to a wicked problem—the patient's access to medical records in Portuguese healthcare facilities. The development phases of this project are divided into: 1) literature review; 2) research; 3) exploration; 4) design; and 5) evaluation. This paper presents the development of a mobile application—Olhar Clínico [Clinical Viewpoint]—for sharing patient medical history and discusses its implications for the healthcare context. Results of an evaluation with end users show that the solution brings value to the patient and can potentially soften the distinction between the public and private practice, promoting a cohesive healthcare system.

Keywords: mobile application; interaction design; research through design; research through interaction design; healthcare design

1. Introduction

The Portuguese healthcare system is divided into public and private, and it is often the case that individuals seek assistance in both. The value of a patient centered care (PCC) approach (McCracken et al., 1983) should be considered in this context, particularly because several structures are being used but not properly interlinked, to the detriment of the patient. The patient should be considered the most important element in the healthcare system, not only because of their satisfaction and individual needs, but also because of the impact on the patient's treatment efficiency (Groeneveld et al., 2019).

This paper aims to encourage PCC by exploring ways to facilitate the exchange of medical records. It involves patients enrolled in the Portuguese national healthcare system who seek second medical opinions in public or private sectors. Accordingly, we identify as our research question: "How can interaction design facilitate the access to clinical information in public and private institutions by patients in the Portuguese healthcare system?"

The methodology used includes Research through Design (RtD) and User-Centered Design (UCD). The main objective was generating insights about the solution presented and answering the research question. "RtD is an appropriate research approach to study the features, acceptance, and impact (…) of a design" (Groeneveld, 2020, p. 44).

This research intends to develop a mobile application that considers the motivations, frustrations, and goals of potential users. The development phases of this project (Figure 1) are divided into: 1) literature review; 2) research; 3) exploration; 4) design; and 5) evaluation. The literature review phase focuses on healthcare, data privacy and security, and adequate research approaches. The research phase is

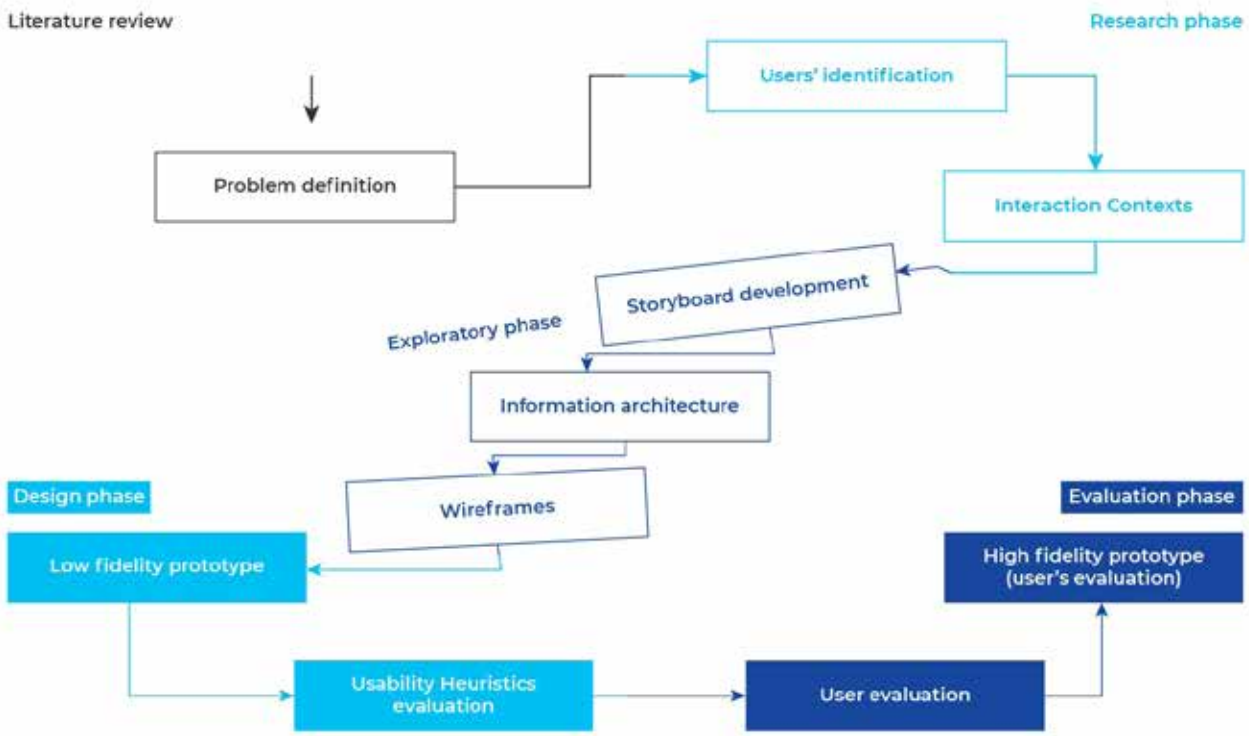

Figure 1. Development process of a digital application for the patient's medical history using an RtD approach.

about identifying groups of potential users by interviewing real participants. The exploratory phase focuses on the development of storyboards, information architecture, and wireframes. The design phase is a conceptualization of the wireframes into a low-fidelity prototype and its evaluation through usability heuristics. Lastly, the evaluation phase is an iterative process of evaluation with end users through performance testing and a SUS (system usability scale) survey.

In sum, this paper presents the development of a mobile application for sharing patient medical history using an RtD methodology, and discusses implications of this technology for the healthcare context.

2. Literature Review

"A patient-accessible medical record can potentially improve medical care in a variety of areas, particularly by enhancing doctor-patient communication" (Ross & Lin, 2003, p.1).

2.1. Patient-Centered Care

Patient-Centered Care (PCC) is an approach that encourages a relationship between the doctor, the patient, and their family to solve a certain problem (Delaney, 2018). By understanding and corresponding to the patients' needs, these can make their own choices concerning a medical treatment that fits them (Levinson, 2011). Linked to PCC, there is patient-centered communication, which intends to improve the patient's experience by actively trying to understand their perspective (Levinson, 2011). The application of PCC appears to positively influence patients' recovery (Olsson et al., 2009; Rathert, 2013), and patient-centered communication plays a big role in it. If the patient has specific needs and PCC seeks to actively listen to them, then accessing the individual's past clinical experiences facilitates a PCC approach. "By facilitating online access to medical information (...) personal health records are envisaged as having a key role in patient-centered care" (Reti et al., 2010, p. 1). For example, chat functionalities between doctors and patients and mechanisms to facilitate

the search for second medical opinions could be considered in the strategy of our research problem, since both are patient-centered.

2.2. Free Access to Healthcare Data: Privacy and Security Implications

Healthcare data accessibility brings numerous problems associated with privacy and security. According to Cushman et al. (2010), the unauthorized access and leaks of sensitive data by external applications might result in discriminating situations in job opportunities or worse, because, although most institutions with access to these data are traditionally clinics or hospitals, there are unregulated organizations with commercial purposes above the associated privacy concerns benefiting from free access to healthcare data. Haas et al. (2011) claimed that existent EHRs (electronic health records) providers share patients' personal data with doctors, healthcare services, and drug stores. According to Perera et al. (2011), most patients and physicians do not agree with medical records being shared with insurance companies, external researchers, and pharmaceutical industries, and do not want the government to have that information. Systems involving sensitive data such as patient medical records must be carefully designed to maintain and preserve anonymity.

Security is also a big challenge in the technical development of such an application. Accordingly, the use of a Blockchain technology could be a good strategy for such concerns (Chen et al., 2020). Blockchain functions through validation mechanisms in a linked computer network that facilitates transactions without the need of authorities or intermediaries to maintain and supervise the system's functionality (Rennock et al., 2018). If a new transaction occurs, then a new block is added to the computer chain with the supervision of clever code and mass collaboration between the network blocks (Rennock et al., 2018). Peer-to-peer transactions are a fundamental idea in blockchain, which means that two identities can make a transaction directly, maintaining their anonymity and that of the permanent records of the transaction (Hassani et al., 2018). The extent of blockchain applicability has already opened opportunities in healthcare, smart cities, energy industries, supply chains and logistics, and Internet of Things (Bodkhe et al., 2020).

2.3. RtD Approach

RtD aims for knowledge production through the development of a solution to a research problem, while evaluating it with end users. It is considered a legitimate research methodology in the investigation of wicked problems (Zimmerman et al., 2010)—that is, those with "innumerable causes, (…) tough to describe, and [without] a right answer" (Camillus, 2008, p. 2). According to Hamilton (2008), research involving healthcare often addresses good examples of wicked problems. The context of this research involves politics, public health, healthcare, health insurance, among other areas, which converge towards a complex problematic. The strategy for our research problem uses interaction design as a tool to develop insights. We did "design as a part of doing research" (Stappers & Giaccardi, 2002) into our problem, gaining preliminary insights into the problematic.
Besides the RtD approach, we also used UCD principles in the design process. According to Abras et al. (2004), UCD is described as the methods or processes that utilize end users' needs to influence the design of a product or system. In our case, while the users were not involved in all the development phases, they were consulted in two phases (research and evaluation) and influenced the options made throughout the design development process.

3. Research Phase

The research phase aimed to define and characterize groups of potential users through interviews with patients in the research context.

3.1. Participants

To achieve an approximate definition of the potential user groups, we conducted structured interviews with participants that fitted the research context: patients or people accompanying patients, registered in the Portuguese national healthcare system, seeking second medical opinions or better healthcare in private and public institutions. The sample consisted of 10 participants, aged between 21 and 58 years old, three male and seven female (Table1).

Table 1. Participant demographic data.

Participant	Age	Nationality	Residence	Occupation	Gender
P001	32	BR	Lisbon	Student	F
P002	22	PT	Lisbon	Working student	F
P003	21	PT	Lisbon	Student	F
P004	25	PT	Lisbon	Dentist	F
P005	23	PT	Lisbon	Working student	F
P006	58	PT	Lisbon	Professional Insurance Technician	F
P007	28	PT	Lisbon	Product designer	M
P008	21	PT	Lisbon	Student	M
P009	42	PT	Lisbon	Restaurant owner	F
P010	21	BR	Lisbon	Working student	F

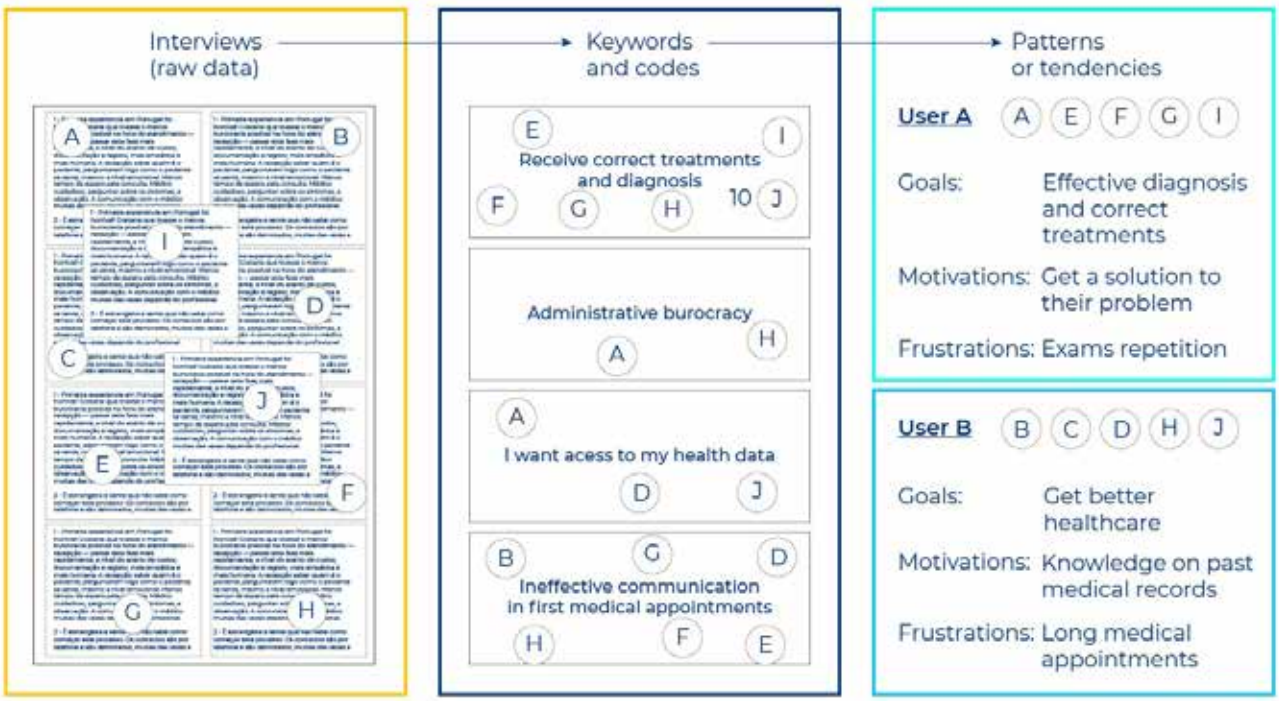

Figure 2. An example of the coding process in the analysis of the data collected (adapted from Adler, 2005).

3.2. Procedure

We conducted interviews focusing on the patients' objectives, motivations, and frustrations. The interviews were conducted during a period of seven days, through the Zoom platform, and included a record consent request. The interviews followed the script below:

How would the perfect experience in a first medical appointment be?

In reality, what are the major problems that you find in the process of medical appointments?

Have you ever needed a second medical opinion? Why?

What do you know about personal data privacy?

Would you consider your health data as personal data?

Would you be able to name the institutions that have access to your health data?

Would you consider yourself a person that easily trusts in others?

Guide me through your routine in a day with a medical appointment.

How would you characterize the communication between doctor and patient?

According to Saldaña (2016), during the interviews, we were finding 'key moments' for pre-coding, highlighting words and phrases that needed further attention in the analysis process. The interviews were recorded for later consultation.

3.3. Analysis

We coded the transcribed interviews and generated keywords from the answers, identifying and groupping approximate profiles of user groups. The search for patterns or tendencies during the coding process, considering the small sample, was done for all the interviews at once, in one coding cycle (Figure 2).

The circles with letters correspond to interview fragments and each column refers to the data analysis phases: the first represents the raw data, the second represents the coded data, and the third represents the potential user characterization.

3.4. Results

The interviews took on average 10 to 20 minutes. Participants expressed disappointment with the overall healthcare service, and some referred to their motivation of accessing their medical records in order to facilitate the communication with doctors when seeking second medical opinions. They also showed concerns about their medical data privacy and referred to the lack of empathy of some doctors, which made them ask for second medical opinions. Most of the codes obtained (Table 2) were linked to ineffective communication between patients and doctors.

3.4.1. User profiles

As a result of the research phase, we characterized two different users. User A's motivations are medical appointments in short time periods, obtaining effective diagnosis, and finding a thoughtful doctor to follow their case. Their objectives are getting their health problems solved and be attended to as soon as possible. The major frustrations are lack of confidence in previous diagnosis, exam repetition, and administrative bureaucracy.

User B accompanies a family member, seeking better healthcare for them. Their motivations are waiting less time for medical appointments, the wellbeing of their family member in medical treatments, and doctor knowledge of their situation. The objectives identified are the pursuit for better healthcare and effective diagnosis in future medical appointments. The frustrations are the lengthy medical appointments in the public sector, excessive administrative bureaucracy, and exam repetition.

4. Exploratory Phase

The exploratory phase aimed to discover possibilities in interaction storyboards, information architecture, and wireframes with the user profiles.

4.1. Procedure

While focusing on the identified user goals, motivations, and frustrations we developed storyboards. The possibilities of interaction were explored in this context and led to the development of the information architecture and wireframes.

Table 2. Codes obtained in the analysis of the interviews.

Codes obtained	Interview data (examples)
"Know the patient", "Correct treatments and diagnosis", "Careful	"The medical staff should know the patient and ask how they feel physically and emotionally" – P001
"Exams lost", "Lack of empathy", Administrative bureaucracy", "Ineffective diagnosis", "Booking medical appointments"	"Due to the lack of public services organisation, the patient should take the exams with him although it might get lost." – P002 "I'm not from Portugal and I do not know how the process is. The contacts are long, unstable and made by telephone." – P001 "In the emergency area of the public service, there is no time with the patient to get an effective and proper diagnosis." – P007
"There is data sharing without a conscious consent", "There is no data privacy", "medical confidentiality",	"I think that our country shares some data with other countries and even the national health system does it without my consent." – P002 "I am aware of privacy concerns in my professional area (dentist), the medical
"I need control on my health data", "not sure if I am the owner of my data"	"it is my health data but nowadays it belongs to healthcare facilities and in my case, if I had access to my medical records, the communication with the second doctor would be much easier." – P001 "I do consider it my personal data and I have the right to access it. However, considering emergencies and extreme cases, health data should be accessible
"Ineffective communication", "ineffective diagnosis", "Access to medical records is helpful"	"The overall communication between patients and doctors is bad, because the patient might not be able to express his health problems or the doctor might misunderstand that information. (…) doctors might even ignore some signals due to their lack of time and miscommunication." – P005 "It's difficult in the first medical appointments. The patient has to

Figure 3. User A's interaction storyboard in a new medical appointment.

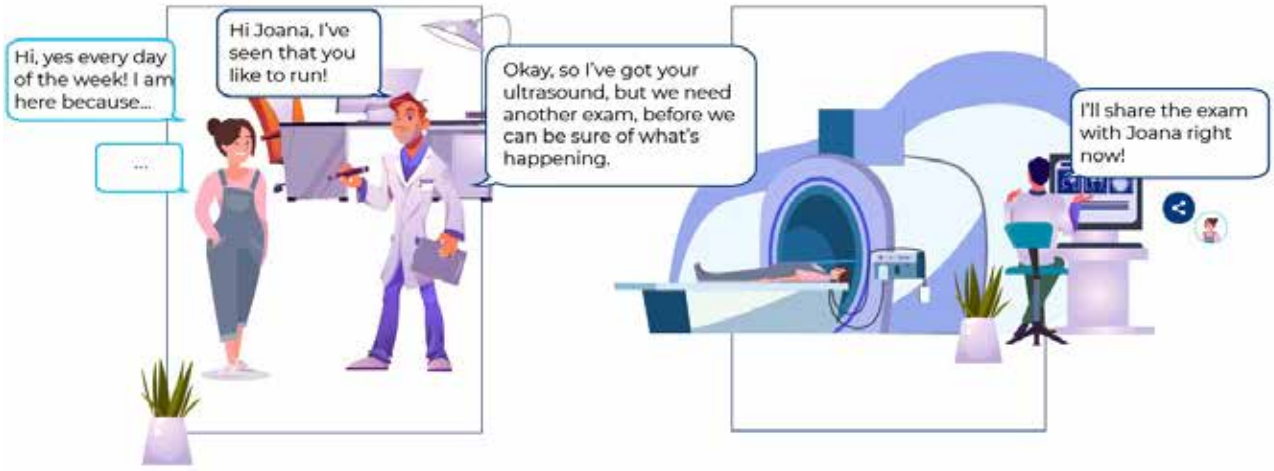

Figure 4. Constant data sharing between the user and the doctor.

For the information architecture, we focused on the user profiles to explore the main interest areas within the mobile application. After that, we segmented the secondary areas such as vaccination records or medication records, which were inside the main topic: medical records. Subsequently, we developed the wireframes—by visually detailing each one of the screens thought in the information architecture, we realized opportunities to improve the original set up, opting for clearer submenus.

4.2. Results and Outcomes

4.2.1. Storyboards

As an evolution of the interaction contexts, we present the example of the storyboard of user A, exploring the interaction between user, doctor, the environment, and the mobile application Olhar Clínico [Clinical Viewpoint] (Figures 3, 4, and 5).

Figure 5. The doctor tells user A that they can message them through the mobile application.

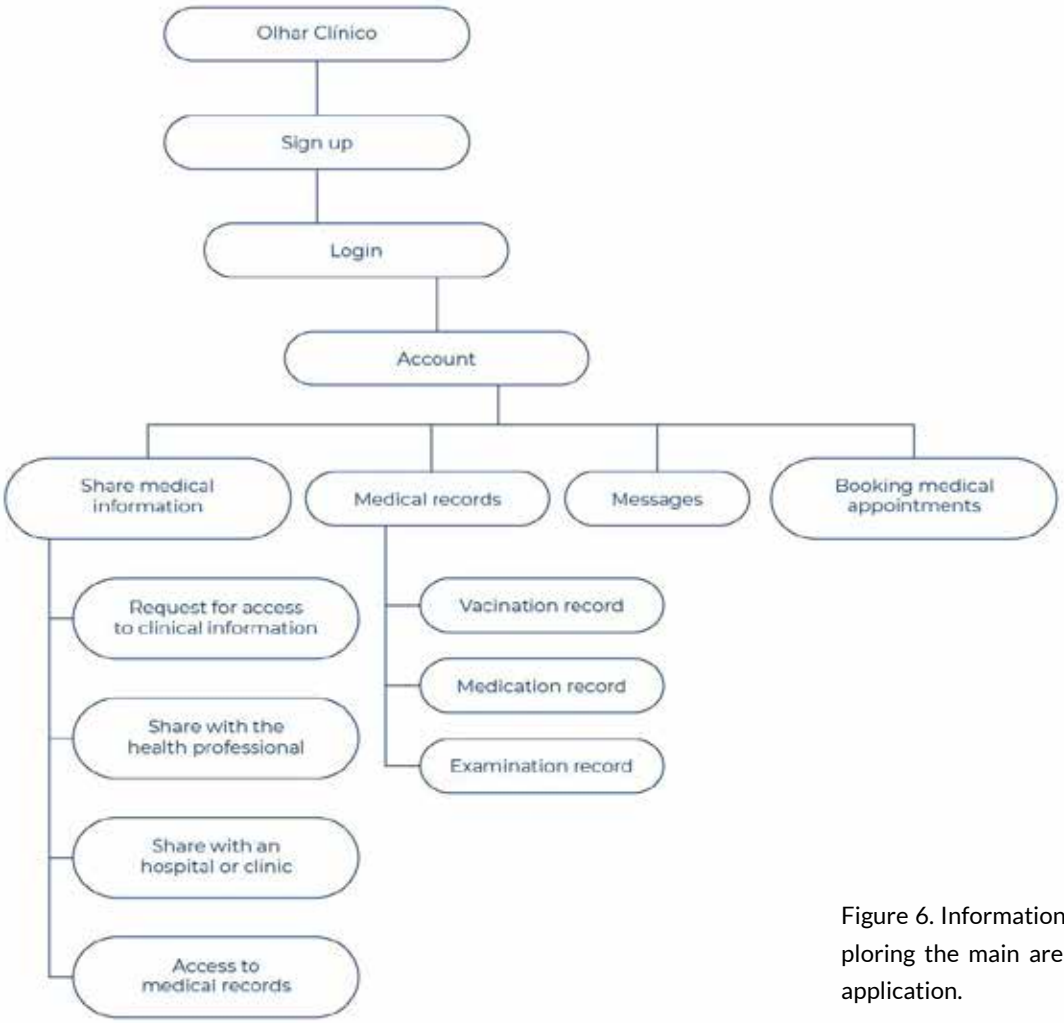

Figure 6. Information architecture exploring the main areas of the mobile application.

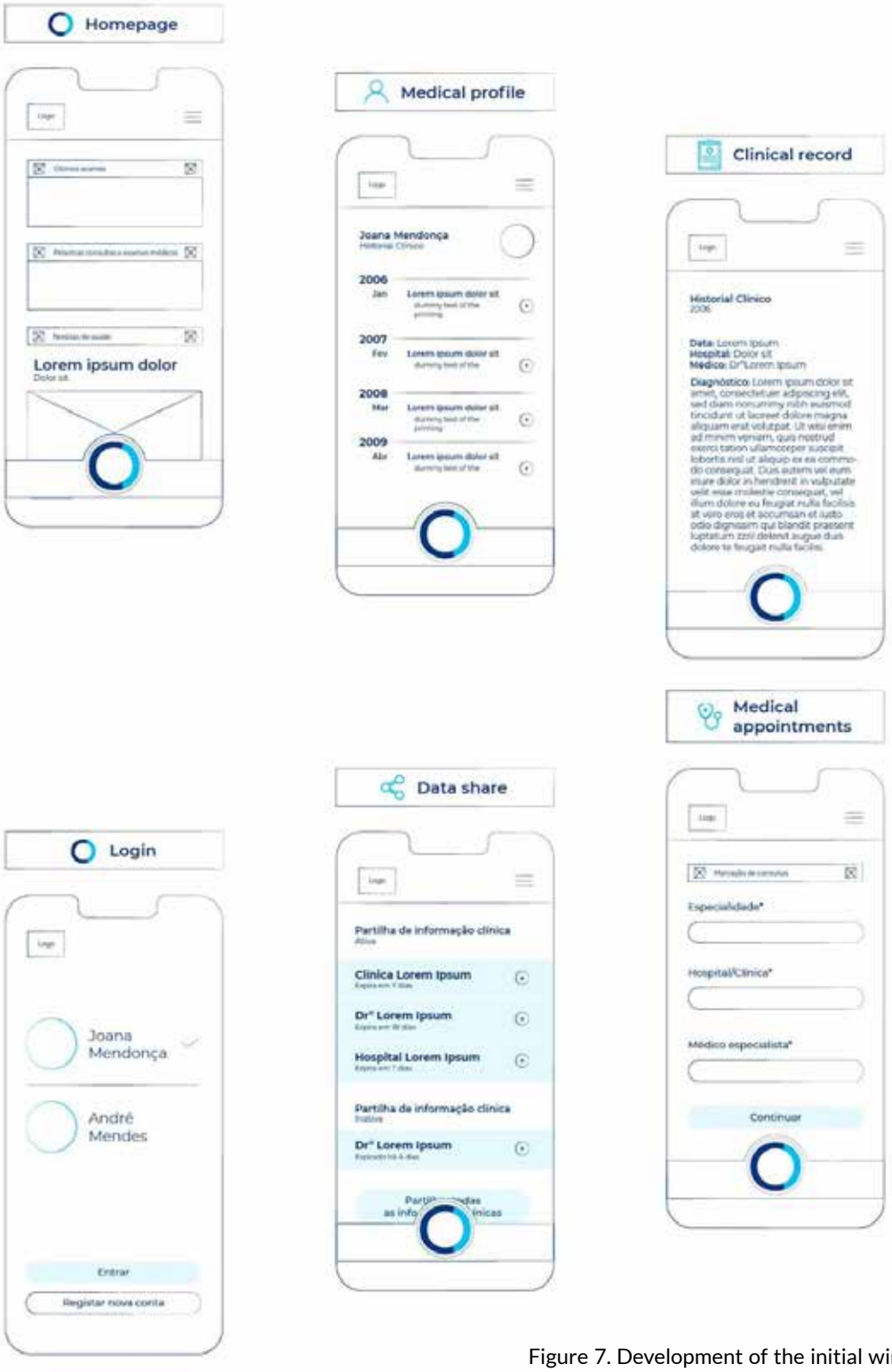

Figure 7. Development of the initial wireframes with attention to the main areas of the information architecture.

4.2.2. Information Architecture

We structured the functionality of the mobile application by setting up the main areas and submenus into a visual scheme (Figure 6).

4.2.3. Initial Wireframes

Due to the early phase of the mobile application development and conceptualization, we were exploring information positioning, menus, shortcuts, and interaction possibilities without focusing on details such as font types (Figure 7).

5. Design phase

The main objective of the design phase was the creation of a medium-fidelity prototype to be evaluated by end users. Beginning with the initial wireframe development we wanted to accomplish a solution to our research problem as a low-fidelity prototype. Furthermore, we carried out a usability heuristics evaluation of the low-fi prototype in order to reach this phase's goal, a medium-fidelity prototype.

5.1. Procedure

We had a special attention here because we were developing the first screens from the initial wireframes. Having in mind the users' goals, motivations, and frustrations in every step of prototyping helped us avoid later problems with the product. The creation of screens, interactions, and animations from the initial wireframes resulted in a low-fi prototype that went through a usability heuristics evaluation. The usability heuristics were consistency, efficiency, feedback, and easy recovery from errors (adapted from ISO/DIS 9241-11; ISO/DIS 9241-110; ISO/DIS 9241-112; ISO/DIS 20282-1; ISO/FDIS 9241-306; Schlatter & Levinson, 2013).

5.2. Analysis

In order to apply a careful evaluation, we used checklists for each usability heuristic, which are included in the tables below (Tables 3, 4, 5 and 6).

Table 3. Usability heuristics evaluation through the usage of checklists: Consistency.

Usability heuristics	Visual	Functional	Internal	External
Consistency	Screen balance Screen symmetry Graphic elements regularity Graphic elements predictability Graphic elements sequentially Space economy Graphic elements unity Color harmony in screens	Functions associated by colors Functions associated by animations The images and graphic elements used are consistent with the page subjects Names consistent with actions Menus hierarchy Navigation options identification	Functional areas localization through screens Types, fonts, colors and interactions Terminologies	Common social conventions: symbols, vocabulary User stability and confidence Real world analogies User expectations

Table 4. Usability heuristics evaluation through the usage of checklists: Efficiency.

Usability heuristics	User navigation	User dialogs with the product / system	Reduce the user short-term memory	Design for minimization	Design to capture the user attention	Readability
Efficiency	Navigation options identification Specific information search identification Mouse and keyboard interactions with the menu Tasks minimization Grouped functionality commands	Quick access keys Data entry	Avoid user	Graphic elements purpose User needs: screens	Assign colors to important tasks Animations to important tasks	Avoid serif letters in digital devices Avoid abuse of capital letters

Table 5. Usability heuristics evaluation through the usage of checklists: Feedback.

Usability heuristics	Error messages	Dialogues
Feedback	Positive error messages The user is not the cause of an error Clear language Avoid unknown codes	Long and short tasks information to the user Avoid negative sentences Help steps are settled chronologically Clear utility information before asking for registration Differentiate “sign in” from “sign up”

Table 6. Usability heuristics evaluation through the usage of checklists: Easy recovery from errors.

Usability heuristics	Avoid using the keyboard to enter text	Inform at the right time and place about mistakes
Easy recovery from errors	Data entry shortcuts	Mistakes and successes dialogues

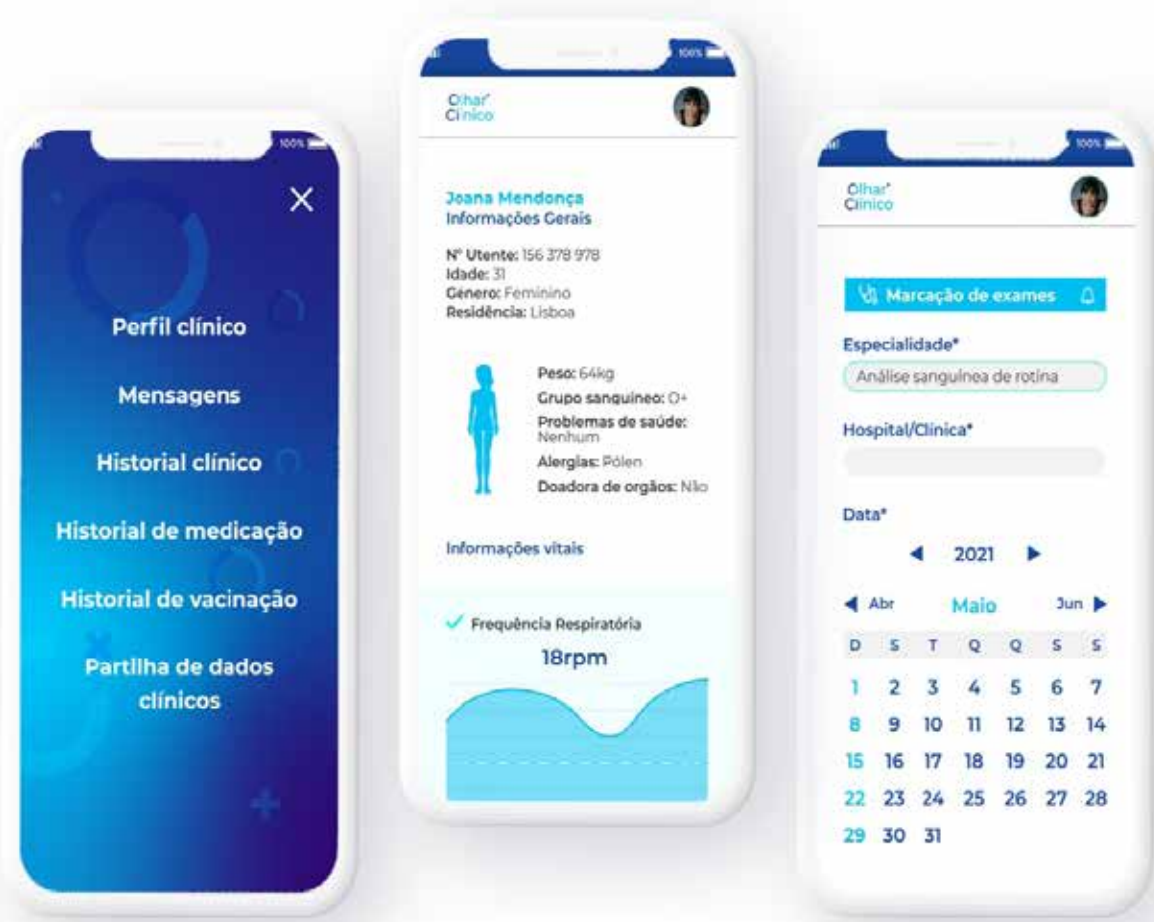

Figure 8. Representation of the low-fidelity prototype.

5.3. Results

The design phase was composed of two different parts: the creation of a low-fidelity prototype based on the initial wireframes and user profiles (Figure 8) and the evaluation with usability heuristics, which resulted in a medium-fidelity prototype (Figures 9 and 10).

5.3.1. Low-fidelity Prototype

5.3.2. Usability Heuristics Evaluation and Medium-Fidelity Prototype

Figure 9. An example of the external consistency evaluation using checklists in the usability heuristics evaluation.

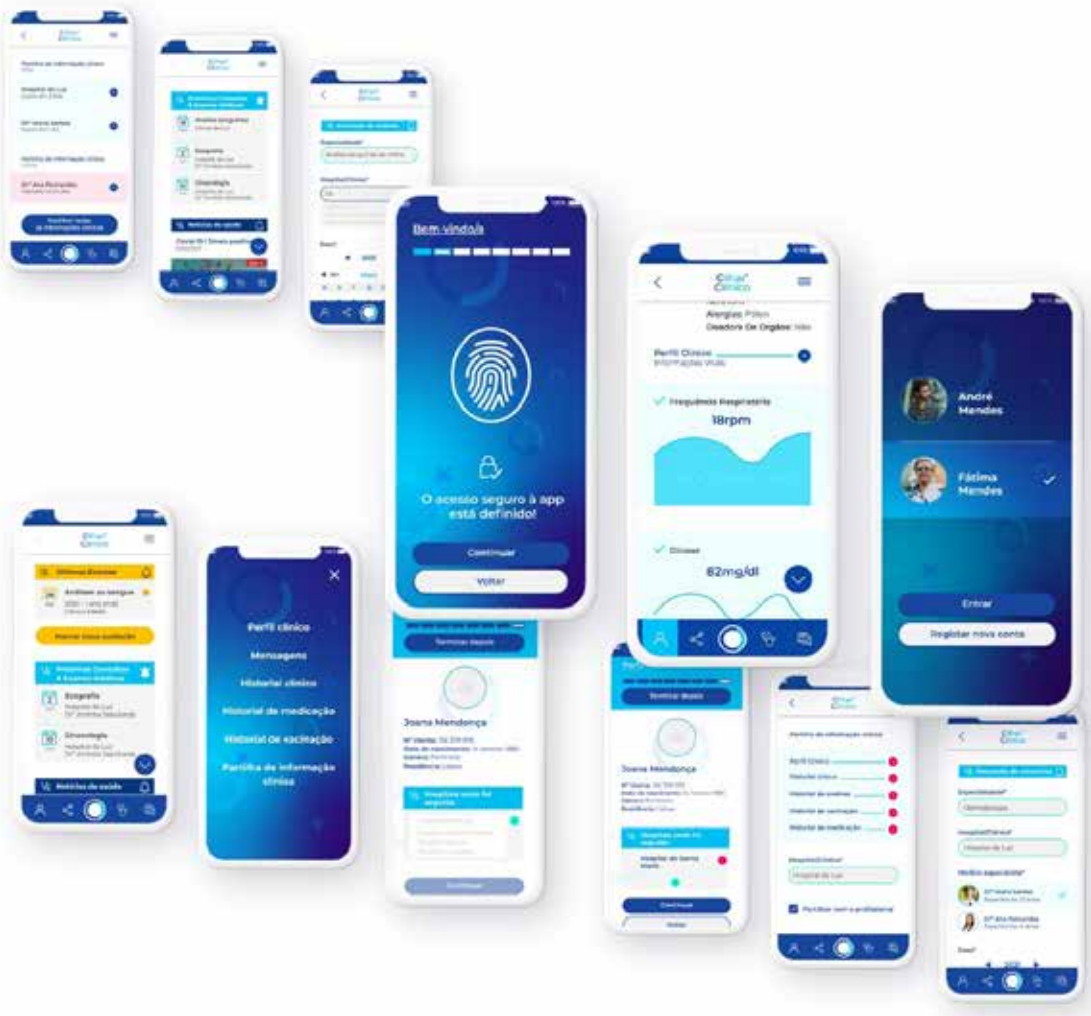

Figure 10. An overview of the medium-fidelity prototype.

Table 7. Tasks performed by end users.

Tasks	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
	Successful registry	Change account	Make a medical appointment	Share medical data	Find a specific	Find a specific information
Task context	You downloaded the mobile application Olhar Clínico, from the App Store or Play Store. Sign up in the platform	You signed up successfully! Imagine that you also manage someone's health data in your family. Enter in their account to check their medical appointments	Make a medical appointment in Hospital da Luz with a dermatologist this week	Since you have your medical appointment scheduled, share your medical information with your new doctor	Find your health data, like your heart rate	Find clinical information from a past medical
	120s	20s	40s	40s	20s	20s

6. Evaluation Phase

The evaluation phase intended to improve the medium-fidelity prototype through an evaluation with end users. It was conducted in the form of performance tests and a SUS survey, using sample from the interviews (Table 1).

6.1. Procedure

For the performance testing, we conducted two rounds: the first round with three users where we found improvement opportunities and a second round with four users that evaluated the improved prototype. For both rounds, we defined a set of six tasks (Table 7) to evaluate due to their importance for the application's functionality. The testing was conducted through the Zoom platform in individual sessions, which took around 20 minutes. We presented a short session guide for the tests and applied a SUS survey at the end of each performance test.

6.2. Analysis

For the analysis, we used the DataLogger V5.0—an excel tool developed to help record qualitative and quantitative data during usability evaluations (Zazelenchuk, 2009). During each individual session we had to select the best option for the users' performance as 'easy,' 'medium,' 'hard,' and 'assist'—if the user needed assistance to complete the task—, or 'fail'—if the user stopped in the middle of the task. In the beginning of each task, we would start the excel tool clock to keep track of the time spent and write any explicit difficulties during the navigation through observation. In addition, we selected the best option for the user's confidence level while completing the task from level one to seven based on observation. At the end of each performance test we applied a SUS survey.

6.3. Results

The tool automatically generated the charts displaying the measured effectiveness and efficiency of the product evaluated. In this section we present the performance tests charts that helped us improve the mobile application with data about the time spent and observations about user difficulties.

Chart 1. Task performance for the first round of tests

Chart 2. Task completion and confidence for the first round of tests.

6.3.1. First Round (Three Performance Tests)

Chart 1 shows that every task was performed by users without 'fails,' however, there was an 'assist' in the "change account" task and two 'medium' scoring tasks where users faced difficulties performing them. Overall, the users performed the tasks easily, but there was enough space for improvement in the "registry," "change account," and "find specific information" tasks.

Chart 2 shows that, overall, users were confident performing the tasks, which indicates that despite not finding what they needed, they were navigating through the mobile application without concerns or expressed doubts. We can identify the "share medical information" and "find specific information" tasks as the ones with higher confidence levels.

Chart 3 shows task completion time, where we verify that the "registry" task took more time than we expected, which indicates the need for adjustments, as in the "find specific information" and "change account" tasks, of which we already had data from past charts indicating improvement opportunities.

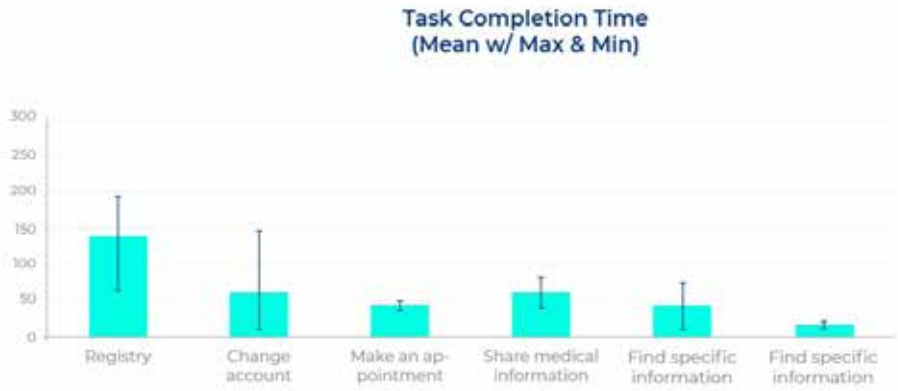

Chart 3. Task completion time for the first round of tests.

Chart 4. Task performance for the second round of tests.

Despite the identified improvement opportunities, a 78,3% SUS score indicated that the usability of the mobile application was good, according to Bangor et al.'s (2009) adjective rating scale. Before conducting the second round of tests, the prototype was improved accordingly. Most improvements were made due to technical errors in the prototype such as small clickable areas or locked screens where scroll was crucial. To solve the "change account" task difficulty, we added an alternative option to swap accounts in the patient's profile and reorganized the main menu options by grouping all the options related to medical history such as vaccination or medication records in sub-groups. In the "registry" task, we identified some technical errors with the prototype that were interfering with the task completion flow.

6.3.2. Second Round (Four Performance Tests)

Chart 4 shows that after the improvements, the same tasks had better results without assistance needed.

Chart 5 shows how the improvements on task completion rates influenced the confidence rates.

After the improvements, we verified that the users are spending the expected time performing the tasks (Chart 6). However, users faced difficulties in the "find specific information" task, which is visible in the data analysis. Due to the lack of logical reasons and improvement opportunities, future tests are needed to solve this issue.

Chart 5. Task completion and confidence for the second round of tests.

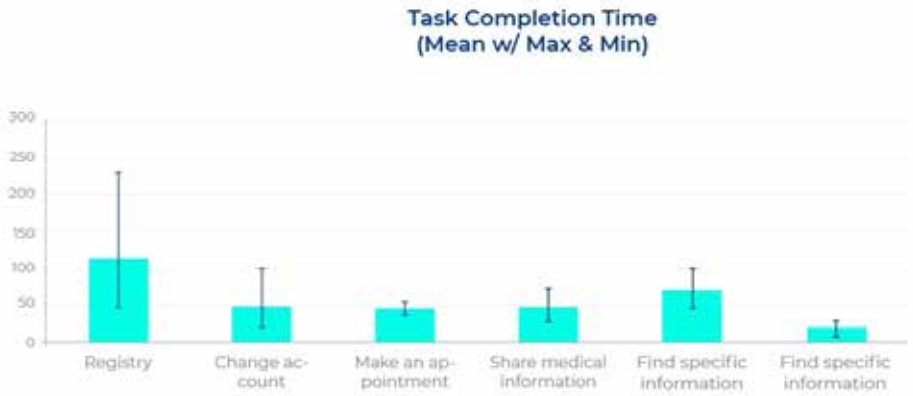

Chart 6. Task completion time for the second round of tests.

The last prototype had a 88,1% SUS score, making the mobile application an excellent usability product example, according to Bangor et al.'s (2009) adjective rating scale.

6.3.3. Final Prototype

Through the evaluation phase, improvements were made in an iterative process considering users' feedback and performance testing, resulting in the final prototype.

7. Discussion

Some studies point to the expensive cost of implementation and maintenance, and the time consumption of healthcare providers' adaptation to EHR systems (Ray, n.d.). However, we believe that our strategy might bypass this for a few reasons. The mobile application is not invasive—it works outside the system and with the patients' consent. The patients are the owners of their clinical data and they have the power to share it with new doctors, clinics, and hospitals. Doctors and other medical staff would not need adaptation, because their workflows would be the same; however, the healthcare facilities administration sectors would have more work. To solve this crescent volume of work, we encourage further research in a system across all healthcare facilities.

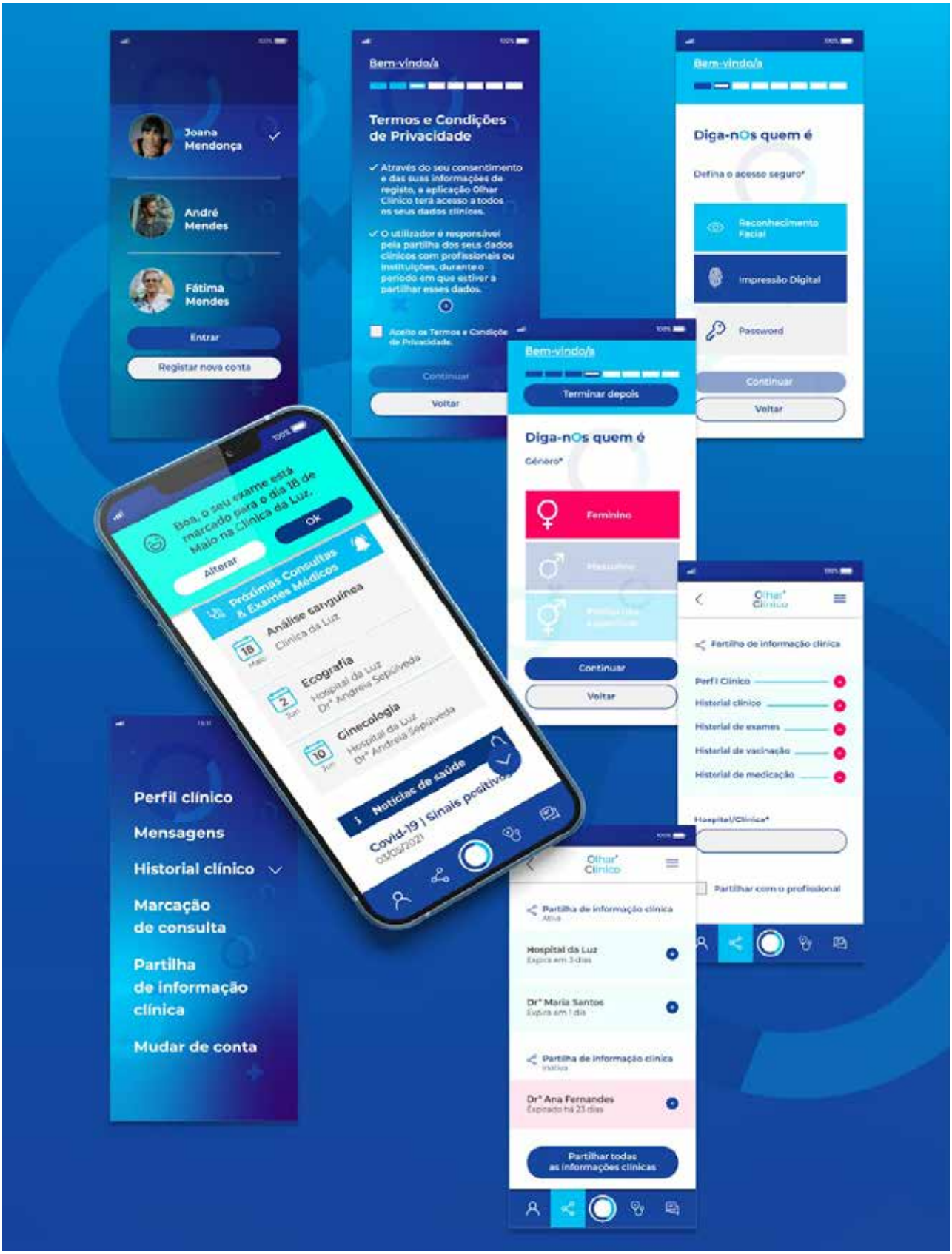

Figure 11. Final prototype of Olhar Clínico.

The fact that patients are the owners of their data is desirable but not perfect. We believe in the possibility of patient control over his/her data to some extent. Healthcare facilities must be informed of patients' clinical history to some point, for instance emergency entries where patients are not conscious or are carriers of communicable diseases that might harm public health. Without considering these situations, healthcare facilities could not provide their services effectively.

8. Conclusions

The RtD approach helped us define a strategy to a wicked problem. The mobile application Olhar Clínico, after the user's informed consent, sends a request to the healthcare facilities asking for their medical records in order to gather past clinical data. Our strategy was to avoid political influence to solve this issue or a total transformation in the healthcare Portuguese system. In the evaluation phase, we observed users navigating through the application without concerns. The users were happy with this solution and the SUS scores validate this.

The blockchain technology usage is a possible approach to the privacy concerns and our participants agreed with it—avoiding sensitive data leaks by healthcare facilities or third parties. Users are informed in the registration process; however, that is not enough. For instance, according to a 2017 survey, 91% of American users accept legal terms and conditions blindly (Deloitte, 2017). Due to these concerns, we carefully designed the terms and conditions screen with a short summary with the most important aspects of the legal agreement and the option to read it all without leaving the screen.

Overviewing our product's intentions and the system's careful care towards the patient, the advantages overcome the disadvantages. By facilitating the communication between patients seeking second medical opinions and doctors in first appointment conversations, healthcare providers benefit from the quality of the services (Xiau et al., 2012). The mobile application Olhar Clínico, by providing patients with their medical records across private and public healthcare facilities, could soften the distinction between the two services, promoting a cohesive and united healthcare system.

5.1. Limitations and Opportunities for Future Research

Some limitations of this study are the reduced number of participants used in the data collection, which could be strengthened with future research with a quantitative perspective. Furthermore, the final prototype was not implemented (coded) and not used with real patients currently in the healthcare system (live and in loco)—which can be done in future research. Lastly, the study was limited to Lisbon, Portugal's capital city; however, Portugal has many regions with different scales and necessities, and further research with those users might bring about improvements to the design.

References

Abras, C., Maloney-Krichmar, D., & Preece, J. (2004). User-centered design. In: Bainbridge, W. (Ed.), Encyclopedia of Human-Computer Interaction, (pp. 445–456). Thousand Oaks: Sage Publications.

Adler, P.J. (2005). Dealing with interviews when creating personas: A practical approach. In Proceedings of Student Interaction Design Research Conference SIDER05 (pp. 84-88). Sønderborg: University of Southern Denmark.

Bangor, A., Kortum, P., & Miller, J. (2009). Determining what individual SUS scores mean: Adding an adjective rating scale. Journal of usability studies, 4(3), 114–123.

Bodkhe, U., Tanwar, S., Parekh, K., Khanpara, P., Tyagi, S., Kumar, N., & Alazab, M. (2020). Blockchain for industry 4.0: A comprehensive review. IEEE Access, 8, 79764-79800.

Camillus, J.C. (2008). Strategy as a wicked problem. Harvard Business Review, 86(5), 98-101.

Chen, C-L., Deng, Y-Y., Weng, W., Sun, H., & Zhou, M. (2020). A Blockchain-based secure inter-hospital EMR sharing system. Applied Sciences, 10(14), 4958.

Crisp, N. (2015). The future of the Portuguese health system. Acta Médica Portuguesa, 28(3), 277–280.

Cushman, R., Froomkin, A.M., Cava, A., Abril, P., & Goodman, K.W. (2010). Ethical, legal and social issues for personal health records and applications. Journal of Biomedical Informatics, 43(5 Suppl), S51–S55.

Delaney, L. (2018). Patient-centred care as an approach to improving health care in Australia. Collegian, 25(1), 119–123.

Deloitte (2017). 2017 Global Mobile Consumer Survey: US edition The dawn of the next era in mobile. Available online: https://www2.deloitte.com/content/dam/Deloitte/us/Documents/technology-media-telecommunications/us-tmt-2017-global-mobile-consumer-survey-executive-summary.pdf

Groeneveld, B., Melles, M., Vehmeijer, S., Mathijssen, N., Dekkers, T., & Goossens, R. (2019). Developing digital applications for tailored communication in orthopaedics using a Research through Design approach. Digital Health, 5, 205520761882491

Groeneveld, B.S. (2020). Talking the walk: Applying data-driven patient profiles in the design of tailored services in orthopaedics (Doctoral dissertation, Delft University of Technology).

Haas, S., Wohlgemuth, S., Echizen, I., Sonehara, N., & Müller, G. (2011). Aspects of privacy for electronic health records. International journal of medical informatics, 80(2), e26–e31.

Hamilton, D.K. (2008). Wicked problems, black swans, and healthcare. HERD Health Environments Research & Design Journal, 2(1), 44–47

Hassani, H., Huang, X., & Silva, E. (2018). Big-Crypto: Big data, blockchain and cryptocurrency. Big Data and Cognitive Computing, 2(4), 34.

ISO/DIS 20282-1 – Ease of operation of everyday products – Part 1: Context of use and user characteristics.

ISO/DIS 9241-11 – Ergonomics of human-system interaction – Part 11: Usability: Definitions and concepts.

ISO/DIS 9241-110 – Ergonomics of human-system interaction – Part 110: Interaction principles.

ISO/DIS 9241-112 – Ergonomics of human-system interaction – Part 112: Principles for the presentation of information.

ISO/FDIS 9241-306 – Ergonomics of human-system interaction – Part 306: Field assessment methods for electronic visual displays.

Levinson, W. (2011). Patient-centred communication: a sophisticated procedure. BMJ Quality & Safety, 20(10), 823–825.

McCracken, E.C., Stewart, M.A., Brown, J.B., & McWhinney, I.R. (1983). Patient-centred care: The family practice model. Canadian Family Physician, 29, 2313–2316.

names, dates, reference to a source publication, etc.), should also be given.

Olsson, L. E., Hansson, E., Ekman, I., & Karlsson, J. (2009). A cost□effectiveness study of a patient□centred integrated care pathway. Journal of advanced nursing, 65(8), 1626–1635.

Perera, G., Holbrook, A., Thabane, L., Foster, G., & Willison, D.J. (2011). Views on health information sharing and privacy from primary care practices using electronic medical records. International journal of medical informatics, 80(2), 94–101.

Rathert, C., Wyrwich, M.D., & Boren, S.A. (2013). Patient-Centered Care and Outcomes: A Systematic Review of the Literature. Medical Care Research and Review, 70(4), 351–379.

Ray, P. (n.d.). The Advantages and Disadvantages of Electronic Health Records (poster). Johns Hopkins University School of Nursing. Available online: https://nursing.jhu.edu/faculty_research/research/opportunities/fuld/documents/cohort-1/posters/prema-ray.pdf

Rennock, M.J., Cohn, A., & Butcher, J.R. (2018). Blockchain technology and regulatory investigations. Practical Law Litigation, 35–44.

Reti, S.R., Feldman, H.J., Ross, S.E., & Safran, C. (2010). Improving personal health records for patient-centered care. Journal of the American Medical Informatics Association, 17(2), 192–195.

Ross, S.E., & Lin, C.T. (2003). The effects of promoting patient access to medical records: a review. Journal of the American Medical Informatics Association: JAMIA, 10(2), 129–138.

Saldaña, J. (2021). The Coding Manual for Qualitative Researchers. Thousand Oaks: Sage Publications.

Schlatter, T, & Levinson, D. (2013). Visual usability: Principles and Practices for Designing Digital Applications. Burlington: Morgan Kaufmann.

Stappers, P.J. & Giaccardi, E. (2002). Research through Design. In: The Encyclopedia of Human-Computer Interaction, 2nd. Ed. Chapter 43. Interaction Design Foundation.

Xiao, N., Sharman, R., Singh, R., Singh, G., Danzo, A., & Rao, H. R. (2012). “Meaningful Use” of ambulatory EMR: Does it improve the quality and efficiency of health care?. Health Policy and Technology, 1(1), 28–34.

Zazelenchuk, T. (2009). DataLogger V5.0 [Computer software].

Zimmerman, J., Stolterman, E., & Forlizzi, J. (2010). An analysis and critique of Research through Design: towards a formalization of a research approach. In DIS ‘10: Proceedings of the 8th ACM Conference on Designing Interactive Systems (pp. 310-319). New York: ACM.

Tod. reading for the blind on their fingertips

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Abstract
The Tod. Project was created for an Interaction Design college subject. When we first started studying more about the Artificial Intelligence world, we found that there were a lot of negative aspects about it. As a group, we set out to follow a path that led to a positive and meaningful impact on society. Real help for real people. Our goal was to create a device that radiates simplicity and accessibility while establishing inclusion as our main goal, in order to provide the visually impaired something of real use and that could, in a way, change their lives. Tod. is born through the belief that technology and AI have more positive things to offer us as a society, especially in our daily lives, and that it should be put to use to help those who need it the most.

Keywords: Interaction Design, Artificial Intelligence (AI), Braille, Visual Impairment.

1. Artificial Intelligence research

With Artificial Intelligence as a motto to this project, we have to understand its meaning and the way it is used and implemented in our lives. Artificial Intelligence (AI) refers to the simulation of human intelligence in machines, the ability to rationalize like the human being and mimic their actions in whatever task is given to them. It's this kind of technology and the diverse fields of study and even issues around it, that is already being used and debated in most corporations, and some say it's the answer to the future.

As technology evolves and becomes more common, these AI devices immersed in our daily lives must also mature in order to better adapt themselves to meet our needs or maybe even surpass them. The goal is to incorporate smart objects in routines and make them as autonomous as possible, capable of observing and learning human behaviours so that eventually, they will be able to predict our future behaviours and adjust its services to our necessities and preferences. This involves Machine Learning.

Since AI is so unnoticeably available these days, it doesn't even cross our minds the considerable amount of tools, material or digital, that we own in which it is present. From smart personal assistants, such as Alexa or Echo, through online shopping, voice-to-text features, email assortment and organization to social networking in apps like Facebook or Instagram. The decisions we make and content we post contribute to the enrichment of AI knowledge, which consequently will be used to dictate the type of suggestions offered to us while interacting with these tools. This raises questions such as data surveillance, invasion of privacy and security, trust deficit or even bias related problems, which make some of the major flaws in Artificial Intelligence.

2. Conceptual Framework

2.1 Positive approach

The negative side is quite present in the way that AI plays us as a society and transforms us into "robots" at its service. The question regarding data privacy is also something

quite impactful for which we wanted to find a solution, as a group. Being conscious about it was the first step but we didn't want to end there. We sought to elevate the theme and find real solutions.

Trying to evaluate in which way we could find a positive side in AI, we realised that we'd have to focus on a greater goal. Something that would be inclusive and of real use for someone, a non-pervasive but necessary use. A tool, not a weapon. Following this line of thought, we came up with ideas of what would be the project and in which target audience it would have the most
positive impact.

2.2 Visual Impairment research

Visual impairment can be defined as a decreased ability to see to a degree that can't be fixed by usual means, such as glasses. This condition varies from mild vision loss, to total blindness and can occur due to injury, disease or genetic conditions. Despite generally affecting a person's ability to read, it's sense of orientation and awareness of its surroundings, visual impairment can lead to difficulties in communication and language development, which in an increasingly visual world, can lead to a huge gap in the access of information.

2.3 Daily struggles of the visually impaired

In developing a product destined to be used by visually impaired people, first comes the need to understand the way they perceive the world, their daily struggles and limitations, how they perform the most mundane activities and the important role of the other 4 senses of the human being. This implies an intensive research on solutions and systems used in already existing devices for visually impaired people, in what ways they are useful and practical to them and why.

3.2 Contacting ACAPO

For an even more accurate answer to these questions, we got in touch with ACAPO, the portuguese association of blind and amblyopic people, where we received the testimony of the community itself and their personal perspective on the daily struggles of a blind person, a crucial part in the process of designing and inclusive device.

3. Tod. Project

3.1. Foundation and Problem statement

Focusing on one of these daily struggles, the project addresses the lack of access to written information by visually impaired people. To do so, it takes hold of braille, the universal alphabetic writing system for this community, that uses raised dots to represent the letters of the alphabet.

Looking around, we are constantly presented with written information, whether it be in street signs, product labels, or the more obvious, books. Visually impaired people are deprived from all this information, and although there are certain books and products (mainly medicines) that contain braille translation, these are very few compared to what this community does not have access to.

3.2. Concept and advantages

The following project comes to solve this problem through the help of Artificial Intelligence. It consists of a device that uses AI to automatically translate text and characters into braille. The device, that goes by the name of Tod. originated from the word "dot" as the fundamental unit of the braille system, will work as an auxiliary gadget/mechanism for its user, allowing him to read all sorts of written information, such as product labels in supermarkets, menus and schedules, street signs and posters, books, etc.

The goal is to allow visually impaired people to access more of what other people can read, in an effort to help them become more independent and involved in society.

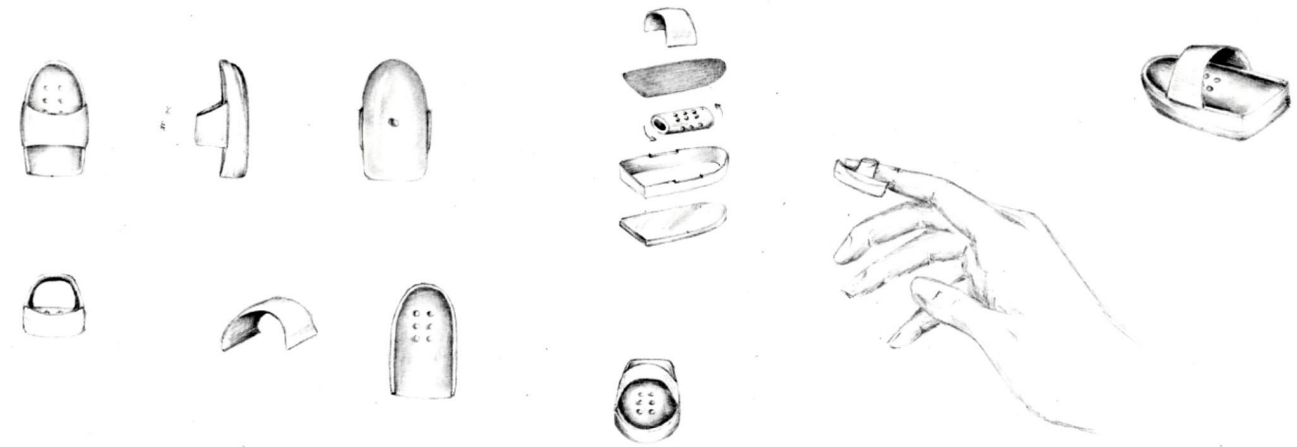
4. UX Design

4.1 Personas

To better understand how this device would work and the different scenarios of its usage, we created three personas with different backgrounds and characteristics in which the experience of using Tod. would have a specific role and impact on their lives.

4.2 Tod. Design

Taking in account the fact that visually impaired people don't navigate the world the same way as we do, our device needed to be designed in order for this community to use it easily. As such, we had to create a device that was simple and intuitive.



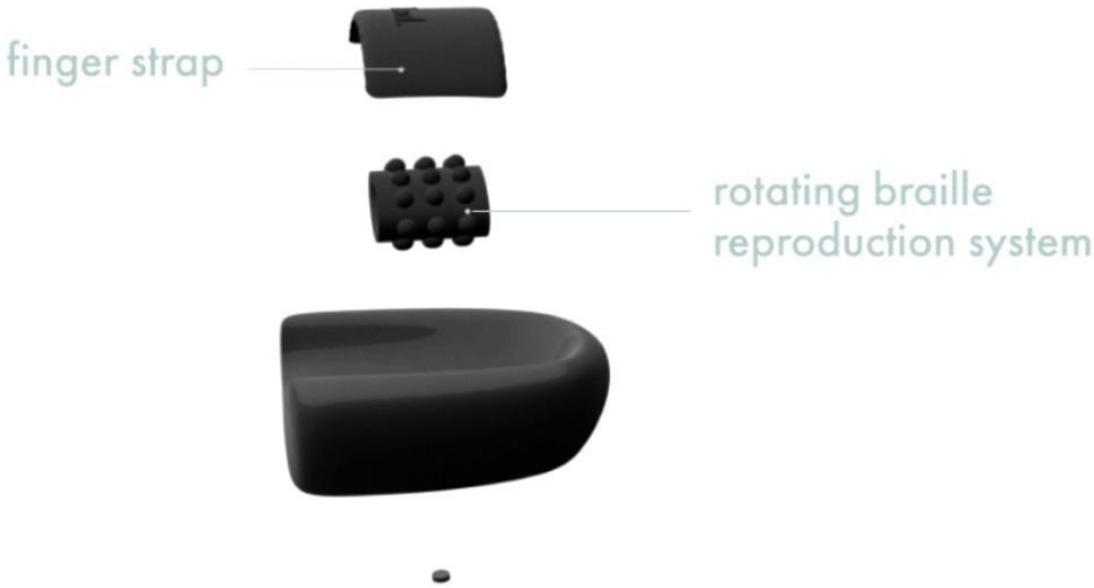
First sketches

3D prototype

4.3 Functionality

Our device is made up of a simple system. A scanner reads and analyses the text through contrast. The collected information is then transmitted to a rotating braille reproduction system that slides the braille correspondent to the text under the user's finger, mimicking the natural braille reading movement. The user can simply put the device on its finger and Tod. will automatically vibrate to inform it's been turned on. If the battery starts running out, Tod. will vibrate three times to let the user know it needs to be charged.

Tod. was designed to be comfortable and very intuitive and even the charger was made to fit the target audience needs: it's wireless so, as long as the charger is plugged in, the user can simply put the Tod. on top of the charger, and doesn't need to worry about connecting anything to the device.



Device parts and functionality

4.4. First sketch and Blender prototype

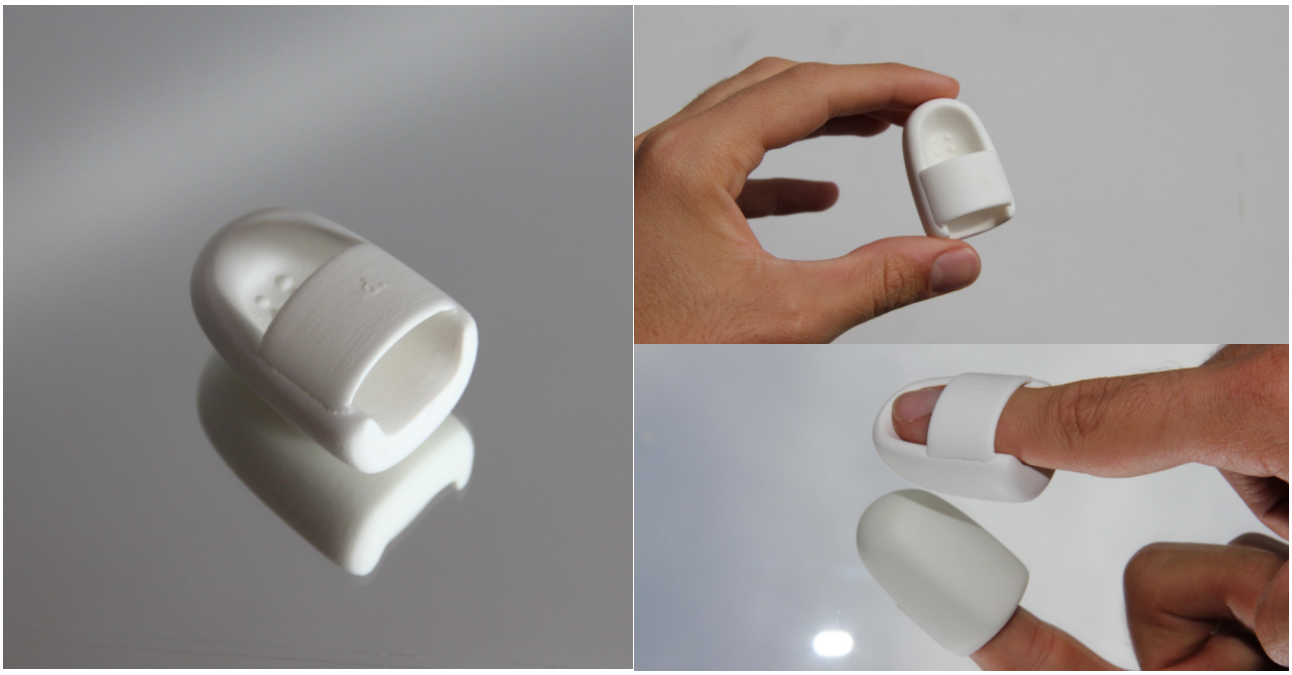
In order to visualize our idea better, after sketching out the idea, we designed Tod. on a 3D software. We decided it would be available in both black and white and even animated Tod. in order to see what it would look like while it's being used.

4.5 Website, teaser and packaging

The website was born from the need to publicize Tod. Given our target audience and their needs, we created an audio button that works as a translator to the website content.

The home page contains a virtual tour of the device that explains, through animations, what it is, how it works and its functionality. There's also some shots of the 3D printed model and teaser video. The 'Get your Tod.' page allows you to buy Tod. and select your preferences such as the colour and the option to add a charger, (in case the user already has one and doesn't feel the need to buy another).

The packaging is also available for preview in this tab and, once again, it was designed to be as intuitive as possible. Instructions are placed on the packaging, in braille, making it one single object with no loose pieces that could be potentially easy to lose.



Real scale 3D printed model

Tod's package

Frames from the teaser

If the user wants to know more about the project itself, there's also a tab created for that, the 'About page'. In an attempt to create a sense of connection with the target audience we explained our project's concept and presented our initial sketches for Tod.'s design.

The Tod Project can be consulted at: https://todproject.weebly.com

References

ACAPO – Associação dos Cegos e Amblíopes de Portugal http://www.acapo.pt

Nordlander, T. E. (2001). *AI Surveying: Artificial Intelligence in Business.* Tese, Montfort University. https://www.researchgate.net/publication/245235667_AI_Surveying_Artificial_Intelligence_in_Business

Hollingshead, T. (2019). *Are Siri and Alexa making us ruder? The answer is….* Brigham Young University. https://news.byu.edu/intellect/are-siri-and-alexa-making-us-ruder-the-answer-is

Rawassizadeh, R., Sen, T., Kim, S.J. *et al.* (2019). *Manifestation of virtual assistants and robots into daily life: vision and challenges.* https://link.springer.com/article/10.1007/s42486-019-00014-1

Guy, Richard. (2019). *Artificial Intelligence and Pervasive Computing* https://profitpt.com/2019/12/09/artificial-intelligence-and-pervasive-computing/

Thangadurai, George. (2018). *Wearables at work: Why enterprise usage is outshining consumer usage* https://internetofthingsagenda.techtarget.com/blog/IoT-Agenda/Wearables-at-work-Why-enterprise-usage-is-outshining-consumer-usage

atma.
Interfacing with the Brain

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Abstract
Science is constantly seeking to allow mankind to better itself and overcome the boundaries imposed by nature. However, with the evolution of technology and the growth of human knowledge, the paradigm is now changing: science aims to create a new human. By creating a new way of thinking towards the future, Transhumanism advocates the possibility of human evolution beyond its current physical and cognitive limitations by means of science and technology. The project atma. intends to transcend human capacities by pushing its boundaries, expanding the core faculties of the mind and the way we think, feel and sense.

By analysing the potential of the human mind, the work aims to explore, transcend and enhance, aspiring to an utopic future based on the possibility of total neural control. According to the transhumanist values and scientific research, the project's tender consists in interfacing with the brain, through a brain machine interface system that enables a computer or other digital device to communicate with the intellect. This way, the interface's main goal is to map the human conscious, preconscious and unconscious mind, by analysing in real time all neural activity. This conceptual approach not only proposes the interpretation of the collected data, but also the possible control over the brain, from giving the possibility of controlling your own emotions to deleting your own thoughts.

As a result of this approach, atma. seeks to explore the possibilities that the transhumanist philosophy provides and to emphasize what we have the potential to become. In doing so, atma. elevates the idea of not being limited by traditional methods, instead we can also use technology to enable us to go beyond what some would think as "human". This technological means now give humans effective cognitive abilities that far exceed those of biological brains.

Keywords: Transhumanism, Cognitive Enhancement, Neurotechnology, Interface, UX Design

1. Post-Human & H+

Crucial to the development of this project are the notions of Post-Human and Transhumanism. The growth of these concepts as philosophical and scientific movements implies the configuration of different perspectives. All of these perspectives are organized around the notion of "human being" and the need to redefine this term so that today it can be faced as an open notion. The goal, in addition to analyzing the term from an evolutionary perspective, is to face it in constant interaction with the technological and scientific advances, as well as dissecting how the development of the human being affects the space in which it is inserted. This way, Transhumanism is defined as a cultural and intellectual movement that advocates the possibility of human evolution through science, reason and technology. With humanistic roots, its focus is on human enhancement, that is, on improving, expanding and surpassing the limits of the human being, to eventually give rise to a post-human form of life. All of this through recent or future technologies to allow the elimination of aging as well as the great expansion of human cognitive, physical and psychological capacities.

1.1. Cognitive Enhancement

The human's current form is still limited by the boundaries imposed by nature, not only by its physical form but also by its own cognition. Yet, there is a more profound sense in how the constraints of our intellectual system limit our processes of mental activity. Hence, the range of thoughts, feelings, experiences, and activities that are accessible to human organisms do not represent its full potential and they are certainly not as highly developed as they could be.

Being part of the human notion itself, cognition is responsible for the process of acquiring, applying and retaining information and includes crucial intellectual functions and processes as attention, perception, memory, reasoning, judgment, imagination, thought and production of language. This way, improving human cognition affects a wide range of mental abilities, having a great impact on both individual and social level.

According to this perspective, cognitive enhancement may be defined as the amplification or extension of core capacities of the mind through improvement or augmentation of information processing structures. As cognitive neuroscience has advanced, the list of potential enhancements has firmly expanded, being the possibilities created by technology and science the most dramatic advances.

An enhancement is an intervention that improves the human organism in some way, so that a cognitively enhanced person is somebody who has benefited from an intervention that improves the performance of the cognition without correcting some specific dysfunction of that organism. Cognitive enhancement takes many and diverse forms. Various methods of cognitive enhancement constitute the spectrum that includes not only the traditional means, such as medical interventions, education and training (as well as the use of external information processing devices, labeled as ''conventional'' means of enhancing cognition), but also unconventional means as mind uploading, neural implants, created nootropic drugs and gene therapy.

Mind uploading (sometimes called "downloading" or "brain reconstruction") is the process of transferring an intellect from a biological brain to a computer. One way of doing this might be by first scanning the synaptic structure of a particular brain and then implementing the same computations in an electronic medium. A brain scan of sufficient resolution could be produced by disassembling the brain atom by means of nanotechnology. https://www.nickbostrom.com/views/transhumanist.pdf

1.2. Interfacing with the Brain

Humanity is still limited and constrained by its biological boundaries. There are things that are impossible for us because, simply put, we lack the brainpower. The impossibility we are referring to is more like the impossibility for us humans to access our unconscious mind, control our emotions or delete our memories. Given these limitations, this project is based on the premise of extending neural capacities to transcend human limitations through cognitive enhancement and cerebral, psychological and emotional correction.

Consequently, the concepts of enhancement, transcendence and exploration of brain capabilities led to the goal of fully controlling neural activity, exploring the possibilities of cerebral and motor correction and expanding the way we interact with others, with the world and

with ourselves. Proposing the possibility of fully controlling the brain, emotional and psychological control could eventually lead to the creation of a utopian scenario based on the desire for happiness and its control.

In order to explore how current and future technology can connect to our senses, cognition and our life, we speculate the creation of a brain interface based on a BMI (Brain Machine Interface) system, which assumes direct communication between an external interface and an enhanced brain. According to this system, the interface is developed through three stages, from brain interpretation and analysis to the mapping and exploration of the human mind to achieve control over intellectual functions and processes.

Direct control of external devices through brain activity has been studied with some success for the last years, revealing significant results in the field of neurotechnology. The most dramatic potential internal hardware enhancements are brain machine interfaces. For instance, Parag Patil, neurosurgeon and neuro engineer, have demonstrated that multielectrode recording devices would most likely function in humans. Experiments in localized chemical release from implanted chips also suggest the possibility of using neural growth to promote patterned local growth and interfacing.

1.3. Inspiration

To design atma., we were inspired by various scientific projects in the field of neuroscience and neurotechnology. Our main reference is Neuralink, which is developing a Brain Computer Interface that enables a computer or other digital device to communicate directly with the brain. Their goal is to build a fully wireless system that enables communication through a brain implant, called the Link, with potential to treat a wide range of neurological disorders, to restore sensory and movement function.

As a second reference, we took inspiration from the Human Connectome Project, which is constructing a map of the complete structural and functional neural connections performed within and across individuals, iindividuals, offering a unique opportunity to understand the complete details of neural connectivity.

This project represents the first large-scale attempt to collect and share data of an importance and detail sufficient to begin the process of addressing fundamental questions about human connectional anatomy. This unique setting will permit wide use by the scientific community.

1.4. Words of a few relevant authors

We collected some articles on the subject that contribute to enhancing our project's values and not only to facilitate the understanding of the topic but also to substantiate our work.

The Transhumanist Manifesto, Natasha Vita-More:

"I am the architect of my existence. My life reflects my vision and represents my values. It conveys the very essence of my being—coalescing imagination and reason, challenging all limits. Transhumanism calls upon a heightened sensibility to reveal the multiplicity of realms yet to be discovered, yet to be realized. We are exploring how current and future technologies affect our senses, our cognition, and our lives. Our attention to and comprehension of these relationships become fields of art as we participate in the most immediate and vital issues for transhumanity: extending life, augmenting intelligence, and creativity, exploring the universe. Transhumanists encourage experimentation and attitudes of abundance and emphasize the infinite possibilities of self-transformation as we seek new values indispensable to our self-creation. We have no interest in focusing on self-defeating thinking or entropy. We are achieving refined emotions through provocative forward thinking and analytical techniques."

Transhumanist declaration, World Transhumanist Association:

"1. Humanity stands to be profoundly affected by science and technology in the future. We envision the possibility of broadening human potential by overcoming aging, cognitive shortcomings, involuntary suffering, and our confinement to planet Earth.

2. We believe that humanity's potential is still mostly unrealized. There are possible scenarios that lead to wonderful and exceedingly worthwhile enhanced human conditions.

7. We advocate the well-being of all sentience, including humans, non-human animals, and any future artificial intellects, modified life forms, or other intelligences to which technological and scientific advance may give rise.

8. We favour allowing individuals wide personal choice over how they enable their lives. This includes use of techniques that may be developed to assist memory, concentration, and mental energy; life extension therapies; reproductive choice technologies; cryonics procedures; and many other possible human modification and enhancement technologies."

Human Connectome Project:

"Navigate the brain in a way that was never before possible; fly through major brain pathways, compare essential circuits, zoom into a region to explore the cells that comprise it, and the functions that depend on it. The Human Connectome Project aims to provide an unparalleled compilation of neural data, an interface to graphically navigate this data and the opportunity to achieve never before realized conclusions about the living human brain."

Neuralink:

"We are designing the Link to connect to thousands of neurons in the brain. It will be able to record the activity of these neurons, process these signals in real time, and send that information to the Link. As a first application of this technology, we plan to help people with severe spinal cord injury by giving them the ability to control computers and mobile devices directly with their brains."

2. Design Process

In this second part, we created a brief questionnaire to analyze the knowledge of a random sample of people regarding the project's theme and its possible ramifications. The questions address the participants' general notions of the transhumanist movement, its benefits, and, consequently, the interest in an utopian future from the perspectives of the movement in question. This was followed by an analysis that intended to understand the interest in the concept of the project, complemented by the presentation of Sigmund Freud's Theory of Psychoanalysis, which in turn was represented according to the metaphor of the iceberg. This theory divides the human brain into three levels — conscious, preconscious, and unconscious — and was evaluated with questions about the relevance of controlling areas of the unconscious, and the purpose for which these changes would be made. With the one hundred and sixty-six responses, we proceeded to a study that led to the creation of three personas.

The creation of personas was made according to the following five parameters:

— identification (name, age, gender, occupation, location, and characteristics);

— short biography so that the interests of the personas were justified and understood when

using the interface;

— goals you want to achieve;

— personality map;

— pain points.

For the definition of the personality of the three personas to be supported by a scientific basis, a personality map was designed according to the theory of the Big Five Personality Traits, which is based on five personality factors: openness to experience, conscientiousness, extraversion, neuroticism, and agreeableness. The first persona, Benjamin Brooks, a human being, was created to focus his main goals on achieving happiness and emotional comfort. His interest in using the interface is justified by the fact that as a child he suffered from negligent acts by his parents, which, consequently, had repercussions in his adult life. The second persona, Meghan Felicity, a transhuman, aims to increase cognitive ability, challenging her limits, to understand her entire brain. This interest in wanting to increase her cognitive abilities stems from her concerns about society and the growing world population, which kept her interested in the areas of genetics, biology, and technology, serving as a motivation to join the transhumanist circle. The last persona, Eva, an artificial intelligence, was created for scientific purposes. It aims to develop its abilities using the analysis of the human brain and the interpretation of neural and emotional activity, to assess the potential of the human intellect and to surpass it. Its purpose with the collection of information from the interface is directly related to Data Ingestion and Deep learning.

The creation and development of the personas was followed by user journeys and interaction flows. User journeys are a representation of a scheme that depicts the user's navigation in the interface. They are grouped into a set of five levels — phases, tasks, thoughts, emotions, and opportunities, which summarize the path it takes from the moment the navigation starts to the end, where, ideally, it will reach its objective. In the user journeys, several phases are complemented by the various tasks done while navigating the interface, to which thoughts and emotions are matched. For a better perception and visualization of emotions, a linear graphic was created to accompany the emotional state that mirrors the user's thoughts in each phase and corresponding task. As a complement to these four levels of information, opportunities that the interface offers are also available.

The interaction flows were developed based on the flow chart, which consists of a schematization of the interface's information architecture, where it is possible to visualize all the paths that are possible in exploring the interface. Like user personas and user journeys, interaction flows were created individually, to respond to one of the main goals of each persona. Briefly, the architecture of interaction flows is organized into four stages:

— analysis (from the placement of the neural implant to the analysis and interpretation of data);

— exploration;

— selection (according to the objectives to be achieved);

— improvement.

After completing the previous phases, and based on the previously elaborated flow chart, we created wireframes of what would be the visual and functional structure of the interface.

3. Production Design

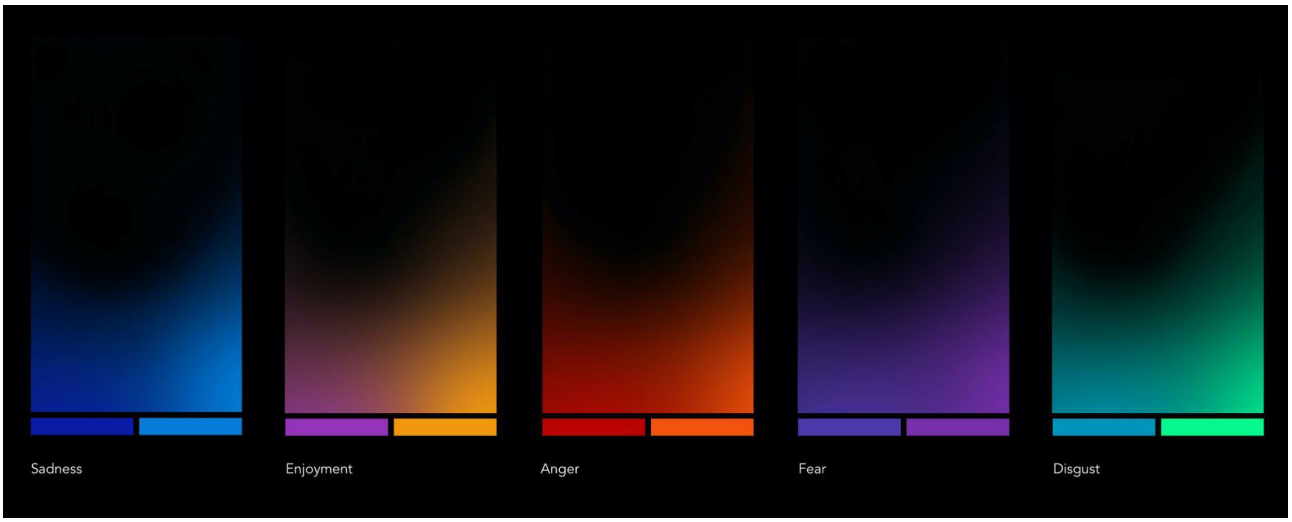
3.1. Visual Identity

The production of wireframes for the interface led us to create the project's visual identity. Establishing the connection between the human mind, the alteration, and control of different parts of our brain and emotional states, we decided to call our project "atma.". The word "atma" is a term used in Hinduism for the soul (spirit, or consciousness) and the principle of life. It also means that is immutable, indivisible, and eternal, the true nature of things. The concept generally used to define "Higher Self" or "Spiritual Being", which is beyond the body and mind, comes close to the concept of "atma."

About the logo, three versions were made that are used throughout the interface, in different situations. The first version, which corresponds to the application name in full, is used only in the connection stage between the neural implant and the interface. The second, which corresponds to a reduced version of the logo, is used in the rest of the interface, always located in the upper left corner of the screen. The third, which again corresponds to a full version of the logo but this time accompanied by a visual element, is used individually during the navigation. The visual element in the third image is a representation of the data analysis process that occurs in the succession of the [successful] connection between the neural implant and the interface. This visual element is also used inside the interface when the user wants to communicate with the personal assistant — when this action happens, the version of the logo found in the second image below gives place to this colored visual element, thus representing the interaction with the personal assistant. This visual element is associated with a color palette, which varies between colors such as blue, lilac, purple, red, orange, yellow, and green, which is associated with different emotional states.

Having as main reference the project "The Ekman's Atlas of Emotions" and the respective color coding associated with the interpretation of different emotional states, we decided to apply the same method of analysis and interpretation in our project, having five pairs of colors, each corresponding to a different emotional state — the joining of two shades of blue, one darker and one lighter, corresponds to a state of sadness; the junction of yellow and lilac corresponds to a state of enjoyment; red and orange correspond to a state of anger; two shades of purple, again one

Logotype



Colors and respective emotional states

darker and one lighter, correspond to a state of fear; and, finally, the joining of two shades of green, one of them being more bluish tones, corresponds to a state of disgust.

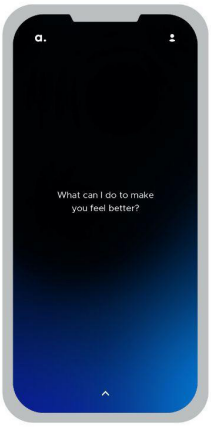
"The Atlas of Emotion was commissioned by the Dalai Lama, his purpose is " In order to find the new world we need a map, and in order for us to find a calm mind we need a map of our emotions". The simple, but not easy, goal of this Atlas is to help us be aware of our emotions. Awareness of our emotions means understanding how they are triggered, what they feel like and how we respond. Awareness itself is a strategy, it helps us understand our emotional experiences. We do not want to get rid of our emotions, we want strategies that help us respond in helpful, constructive ways. Here is a selection of resources that address the development of emotion awareness through contemplative practices, education, and embodiment." http://atlasofemotions.org/#actions/

3.2. UI design & UX design

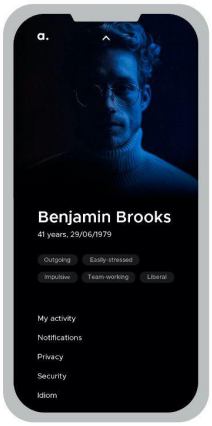
Navigation in the interface is only possible from the moment the user has the neural implant that, later, will give the possibility to start controlling the user's brain. The first moments after entering the interface concern, firstly, a connection between the implant and the system [1], which is followed by data analysis, brain mapping, and creation of neural networks [2], actions that are taking place in real-time. After this analysis, the Home page [3] is presented to the user. In this section, you will find a dynamic

[1] Connection

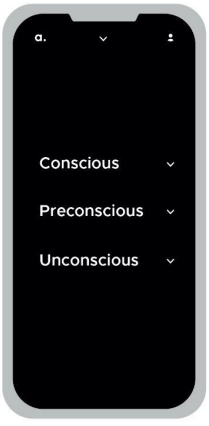
[2] Data analysis



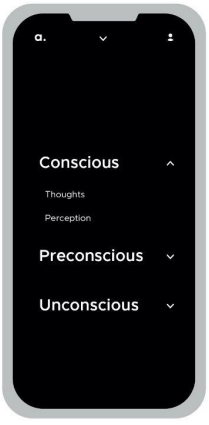
[3] Home page



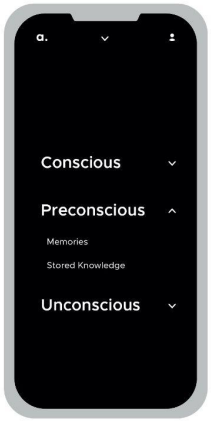
[4] User profile



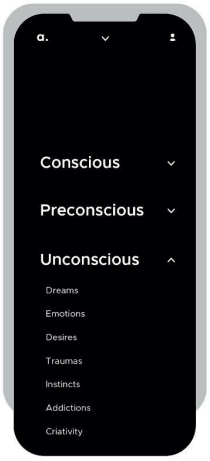
[5] Menu



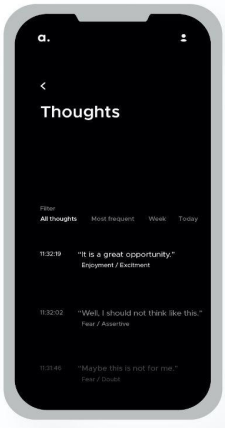
[6] Menu > Conscious



[7] Menu > Preconscious

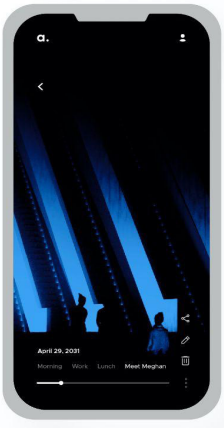


[8] Menu > Unconscious

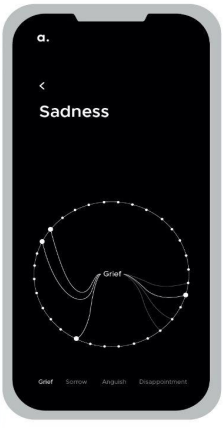


[9] T houghts

[10] Interaction w/ assistant



[11] Memories



[12] Emotions

color background that changes depending on the user's emotional state and the color code mentioned above. As a complement to the information that is possible to extract from the colored background, there are also insights from the interface's assistant that are intended to help the user in exploring the interface and achieving his goals. Through the Home page, it is also possible to access a user profile [4], whose data is automatically collected in the first stages of the interface. The identifying photograph is also colored in one color, bridging with the colors and logic applied to the background of the Home Page. Regarding the Interface Menu [5], which can be accessed through the Home Page, it was built and ranked according to a scientific basis. Similar to one of the questions presented in the questionnaire that preceded the creation of user personas, the Menu organization was designed according to Sigmund Freud's Theory of Psychoanalysis and the iceberg metaphor. Starting from the logic that the human brain is divided into three fields — conscious [6], preconscious [7], and unconscious [8] — and subdivided into several categories, the Menu's organization is then made according to these divisions. Taking the user persona Benjamin Brooks and his goals as an example, the path that the user would have to take to, for example, reach happiness and comfort would be to access the third point of the Menu — the unconscious — which, later, will provide an extensive list of various features of the unconscious, where emotions [12] fall. From there, a graphic is presented that, like the Menu, was built on a scientific basis. According to the concept of psychological and emotional control, the goal is not only human emotional interpretation but also the induction of emotional states.

In a structure organized according to human emotional functioning, the objective is to represent how neurotransmitters (substances responsible for human emotion) act in the various areas of the brain to create various types of emotional states and their possible control. In other features of the other points on the Menu, such as thoughts [9], which are inserted in the conscious area of the human brain, the user has the possibility to access a real-time record of them, which is organized according to filters (all thoughts, the most frequent, weekly, daily) and to eliminate them. Another possibility that the interface offers is that, in the preconscious section, more precisely in the area of memories [11], you can share them on another device (eg, a smartphone), in order to visualize a certain memory that the user had. Like thoughts, memories are also presented according to the same organization and filtering logic, and there is also the option of editing a memory or even deleting it.

Apart from all these technical features, it is important to mention that in any section of the application it is possible to communicate with the personal assistant [10], although it is on the Home Page that communication is more complete given the presence of insights. Communication does not require any interaction by touch, voice or text, for the simple fact that the neural implant at the beginning of the entire process is able to detect a thought that recognizes that the user wants to communicate with the interface, thus making it inclusive for any user.

3.3. User Testing

After creating a functional prototype of the interface, we collected feedback that was divided into some questions related to navigation. With these interviews, we wanted to clarify whether the user experience would be clear and if we had met the goals that we had set ourselves to achieve. The audience we asked about the interface was young and had prior knowledge about interfaces, applications, and interactivity.

The first issue was related to the printing of the interface, which, in general, was characterized as very intuitive, easy to navigate, and with very intelligent use of color. In a second question related to the highest points of the interface, the answers varied, again, between being quite spontaneous, with the use of positive color, and the use of graphics that made the design even more appealing to the experience. The last question was directed to the negative points, where the answers pointed to the need for greater investment in understanding the interactivity between screens, since, on the one hand, it is quite simple and easy to use, on the other hand in some situations it requires a greater investment by the user.

4. Conclusion

This paper has presented a sample of our work designing a speculative digital user-based interface revolving around the theme of cognitive enhancement. This alternative de-

sign concept seeks to explore the transhumanist values as well as the possibilities intrinsic to surpassing the current human cognitive capabilities.

Our research gave us an insight about future possibilities, and made us wonder what makes us human now in addition to what we can become through technology. Questioning how the unstoppable progression of technology may impact humanity, we found that the possibilities around this notion are almost endless.

We elaborated a user-based experience whose main goal is to interface with the human brain and explore the expansion of the intellect. Our work represents a rather unique speculative design practice composed by proposals that interrogate the limitations of human evolution and current technology, and to experience and experiment with the possibility of those alternatives.

References

Ackerman, C. E. (2020). Psychoanalysis: A Brief History of Freud's Psychoanalytic Theory.
Available at https://positivepsychology.com/psychoanalysis/

Bostrom, N. (2003). The Transhumanist FAQ.
Available at https://www.nickbostrom.com/views/transhumanist.pdf

Bostrom, N (2005). The Transhumanist Values.
Available at https://www.nickbostrom.com/ethics/values.pdf

Bostrom, N. & Sandberg, A. (2009). Cognitive Enhancement: Methods, Ethics, Regulatory Challenges.
Available at https://www.nickbostrom.com/cognitive.pdf

Cherry, K. (2020). The Role of Neurotransmitters.
Available at https://www.verywellmind.com/what-is-a-neurotransmitter-2795394

Ekman, P. & Lama, D. (2016). The Ekmans' Atlas of Emotions.
Available at http://atlasofemotions.org/

Human Connectome Project (2009).
Available at http://www.humanconnectomeproject.org/

Neuralink (2016).
Available at https://neuralink.com/

Patil, P. (2003). Learning to Control a Brain–Machine Interface for Reaching and Grasping by Primates.
Available at https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.0000042#s2

Vita-More, N. (1993). The Transhumanist Manifesto.
Available at https://humanityplus.org/transhumanism/transhumanist-manifesto/

World Transhumanist Association (2002). The Transhumanist Declaration.
Available at https://humanityplus.org/transhumanism/transhumanist-declaration/

THE PLAYGROUND - The future of platform capitalism

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Abstract
The Playground is a project addressing the monetization of social media and the way in which these platforms use collected data to develop a selection process that studies and conditions its interviewees through technology to achieve its own independent gains.

The dystopian scenario takes place 5 years in the future when, after decades of data mining the most personal information about the lives of its users, the big tech companies united to create a new and exclusive social network platform called PLAYGROUND, that offers close contact and relationship building with higher status and income individuals. This alliance between Facebook, Google, Twitter, Amazon and Paypal becomes a self-feeding system that uses the individual databases of each older platform to develop a multiple functionality and streamlined services platform.

This platform selects its users through an invite and interview-only process. The reason for this system is to ensure the approval of members that are active on the platform for which they will be compensated for according to their levels of engagement and quality of produced content. The critical moment will be the interview, conducted by an AI which will evaluate how much each candidate is worth to the platform – and to the exploitative goals of the AI and its parent companies. This AI is called MINDER.

The appeal of this platform is its exclusivity, the closeness and networking opportunities it provides to people of similar or higher social status and its social currency.

This platform thus becomes a trap for the collection and commercialization of further data, through the control and enhancement of user interaction through its patented technology, under the guise of an exclusive content-sharing platform, very similar to the way we currently interact with our devices and web platforms.

Keywords: social media; algorithm; artificial intelligence; data-mining; capitalization; systemic bias

1. Algorithm Technology and Data-Mining

Crucial to the development of this project is the notion of manipulative algorithm, its presence in everyday tasks (either for personal or institutional purposes) and the way it is powered by aggressive data-mining.

The increase in technology usage – from online shopping to remote working, personal phones and computers, the advent of streaming platforms and digital personal assistants – has dramatically changed the way personal data is shared, both consciously and unconsciously. As users spend more and more time online and as platforms strive to deliver more personalized content and services, the market for gathering and selling users' data has grown into a multi billion-pound business of tracking, packaging and selling data picked up from public records and private lives. (Venkataramanan, 2014)

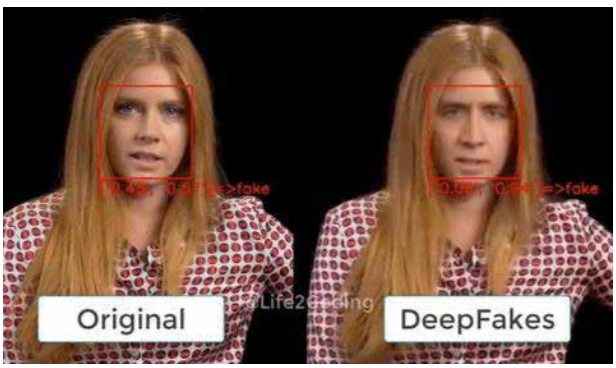
Such predatory behavior around the collection of data – *data-mining* – has enabled evolving algorithms to become

both increasingly accurate and embedded in daily lives' mundane actions and decisions. On our phones, tablets and other devices in our digital world, algorithms hail our Uber rides, decide who we should befriend on social media, and choose shows, movies and products for us to consume. They can even help companies decide what candidates to hire and help universities diversify their student bodies. One day, automakers hope complex algorithms will drive cars more safely than humans do.

It's this pervasiveness of predictive algorithms in users' daily lives that truly showcases its power. Once hailed as the pinnacle of efficiency, as it allowed mechanical and dull tasks to be performed automatically, predictive algorithms have quickly become mediators in important tasks and decisions that directly impact millions of lives. From determining judicial sentencing to bank loan approvals and human resources applications, algorithms are now a common practice for highly sensitive tasks that involve processing large amounts of information. (Hickman, 2013)

However, these algorithms often mirror the detached and mostly white, cis-gendered environments in which they are created. This makes them highly biased and unequipped to understand and consider the different variants, often associated to racist, sexist and xenophobic structures of old, designed to uphold power hierarchies, that push people and communities to the fringes and locks them out of opportunities to fight the same system. (Kara, 2019) These algorithms perpetuate these same systems, as these are considered the template from which to perform. As Viktor Mayer-Schönberger, professor of internet governance and regulation at the Oxford Internet Institute, puts it, in his book *Big Data: A Revolution That Will Transform How We Live, Work and Think*, "That is the possibility of using big-data predictions about people to judge and punish them even before they've acted. Doing this negates ideas of fairness, justice and free will. In addition to privacy and propensity, there is a third danger. We risk falling victim to a dictatorship of data, whereby we fetishize the information, the output of our analyses, and end up misusing it.".

As these algorithms process information and determine patterns, they continue to act on them as a way to determine the best option for institutions and brands to retain and increase user engagement. This means that as it learns and focuses on the user's interests and references, these algorithms begin to build a bubble around the user that effectively feeds them content that mimics their views, blocks diverging voices and information and detaches them from societal discourse that lives in discussion and confrontation of ideas. It lends truth to the idea of a fetishization of algorithms as pantheons of truth, without context or nuance. This blind faith becomes even more dangerous as technological advancements open the way to new forms of falsifying information, such as the case of deep fakes. This AI technology that successfully transplants one face onto another in an ever-increasing seamless operation preys on the difficulty the users have in discerning what is fake and what is not, cloaked by the immense amount of information available online which adds to the increased level of difficulty in finding what is fact and what is fake.



Deepfake of Nicola's Cage face edited over actress Amy Adams footage

2. Problem Statement

The digital platforms that are, at its core, considered public and social spaces (extensions of the real public space sphere) are targets of monetization and exploitation by big companies and conglomerates. This predatory attitude has greatly increased as algorithms have pervaded most of online activity and made it easy for these entities to deploy large-scale data gathering and repurposing operations across the globe. Vulnerable data, however, is not all the same, with minority groups becoming easily target victims, either by the appropriation of information through exclusionary practices already existing prior to the advent of digital cul-

ture, or by actively excluding these groups and focusing on a white, cisgender minority. It is a process that commodifies human beings and targets groups either by denying them access to platforms and services or by harshly penalizing them.

3. Conceptual Framework

The Playground is a project addressing the monetization of social media and the way in which these platforms use collected data to develop a selection process that studies and conditions its interviewees through technology to achieve its own independent gains.

The dystopian scenario takes place five years in the future when, after decades of data mining the most personal information about the lives of its users, the big tech companies united to create a new and exclusive social network platform called PLAYGROUND, that offers close contact and relationship building with higher status and income individuals. This alliance between Facebook, Google, Twitter, Amazon and PayPal becomes a self-feeding system that uses the individual databases of each older platform to develop a multiple functionality and streamlined services platform.

The appeal of this platform is its exclusivity, the closeness and networking opportunities it provides to people of similar or higher social status and its social currency. This platform thus becomes a trap for the collection and commercialization of further data, through the control and enhancement of user interaction through its patented technology, under the guise of an exclusive content-sharing platform, very similar to the way we currently interact with our devices and web platforms.

4. Narrative and Scenario

We took inspiration from a series of cinematic and literary works that in some way already expanded on cyber-security, immersive digital experiences, data-collection and predictive behavior. These references are: Neal Stephenson's *Snow Crash*, 2017; William Gibson's *Neuromancer*, 1984; George Orwell's *1984*, 1951; David Eggers' *The Circle*, 2013; David Cronenberg's *ExistenZ*, 1999 and Alex Garland's *Devs*, 2020.

The outcome took the form of a dystopian scenario, as a hypothetical extreme situation is better suited to illustrate abstract notions of power applied to mundane reality. In this very near-future reality, a new platform created by a conglomerate of key web-based platforms and networks is set to invite users to join an exclusive web environment where they can share and produce content, collect big-ticket rewards and intimately mingle with the rich and famous, all through an ever-present device that acts as an always listening assistant – the Minder.

It's the Minder who is responsible for inviting and interviewing possible candidates for the platform, based on the amount and quality of content they can bring into it, as well as for the relevance and status they already carry socially in other web platforms. The selection and subsequent interview process rely heavily on the collected data it gathered from outlets owned by its parent conglomerate company, and this same information is used to develop predictive and hyper realistic scenarios which it uses to control/influence/blackmail the interviewees.

5. AI – Technology & Representation

Taking center stage in this experience, and being the mediator between the interaction of the interviewees and the platform they are trying to be accepted on, the Minder is the crucial element that mirrors not only the interests of the Playground and the companies that created it, but also mirrors the type of relationship each interviewee develops with it, even if just for a brief moment. As such, careful consideration went into developing its appearance, its voice and the personality it showcases.

As the evolution of AI technology progresses, so does the relationship humans develop with these machines. At times skeptical and other times with dazzlement, the truth is most of this relationship is guided by a human intent to model something it can relate to and identify itself with. Hence, when looking to develop an interactive AI entity, humans turn to a more humanoid casing for this technology.

However, the line between developing a relatable and appealing AI and one that incites disgust and strangeness is a fine one. Coined by Masahiro Mori as "The Uncanny Valley", the term is related to the dip in affinity humans ex-

perience when a robot or an AI entity crosses the threshold of human likeness and becomes disturbingly similar to a human. (Caballar, 2019) This reaction actually promotes an adverse reaction in human receptivity towards robot interaction, promoting not only discomfort but also distrust towards the technology.

It is a phenomenon that can also be observed in digital constructs of human-like entities. With the rise in synthetic media – either through virtual assistants, chatbots and virtual beings – the same tightrope is being walked. (Dirik, 2020) With synthetic supermodels and influencers already hitting social media, many of these are already the focus of discussion due to their human likeness being almost indistinguishable and what that might mean for human representation when perfect bodies can be developed on computers and broadcast globally. (Riparbelli, 2019)

Brud's Digital Creator Miquela, the first fully digital AI supermodel

At its core, the mistrust and disgust identified in Mori's Uncanny Valley can be traced to human distaste for the unknown. Much like its physical manifestations, a similar reaction can be seen as AI, through deep learning technology (machine learning methods based on artificial neural networks and analysis of large amounts of data), starts reaching outside of the expected boundaries set up by humans. As AI now develops new ways of rationale and regulatory rules that developers cannot review for themselves, this already dubbed "Black Box" technology fuels concerns over how these systems can regulate themselves and what directives drive them in their relationship with humans.

Some developers believe the solution might be in patterns of behavior or personality that can be taught to AI as a way of teaching them how to better communicate and understand human behavior. (Chia, 2019) This would open the way to tailored interaction with AI, as it can collect information about each user to better match a personality type to allow for more transparent communication. (Skloot, 2020) What the public and regulators need is reassurance that there is a way for everyone to have some understanding of deep learning agents, and that there is some level of predictability in their behavior.

However, as stated before, systems are always a representation of those designing them. And in such a delicate field as human behavior, and consequently AI behavior, even these behavioral boundaries would have to equate exceptions and deviant actions, such as those that disguise true intent.

Bearing in mind this dualistic relationship between human need and AI intent, the Minder does not seek to alienate its users – avoiding human representations of itself, apart from its "voice" which although fluent is still recognizably mechanical – but does not reveal any identifiable emotion as a way to safeguard its own interests.

We decided to adopt a more abstract visual representation. Using the *Moiré* effect – characterized by perpendicular lines that when associated with movement create a sort of melting screen effect – we were able to provide a digital visual identity to the AI that directly references the idea of a digital entity using a screen to communicate to humans. A sort of double digital interaction to create a dynamic yet disrupted visual presence that humans often associate with the idea of error or digital glitch.

The Moiré effect was also chosen as its wave-based movement could be utilized to mimic the sound waves of the Minder as it spoke. This coupling was the deciding element when choosing the voice for the AI. Not looking for a voice that closely resembled fluent human speech, we chose a type of voice that is reminiscent of the current models for Alexa, Cortana or Siri. A digital voice that constructs its dialogue by piecing together different words to construct a sentence that, despite its grammatically correct construction, still bears marks of a broken pronunciation. As mentioned above, regarding the Mori's Uncanny Valley, a voice that too closely resembles the human intonation can awake

feelings of unease and mistrust on the listener. As such, this mechanical voice assures the listener, to some extent, that they are interacting with a digital AI, with which they are more prone to provide sensitive information, as they have done throughout their digital life.

Finally, with both these elements selected the development of the Minder's personality and the goals that drive its interaction with the interviewees was the final step needed to give the project a clear direction.

6. AI Interaction and Personality

Humans and AI can interact in a number of different forms, most commonly, with the technology that is now available, this is done through the medium of screens, either on phones, tablets, desktops or laptops. In fact, humans are almost always interacting with AIs when they are connected to any of those screens and an internet connection, whether they know it or not. Most of the AI active today, through the form of algorithms and data mining programs, machines who learn through the amassing of large quantities of data, is invisible to the average human user. The human puts information into the network, either by giving information about themselves or through their usage habits, and the AI collects and interprets this data.

There are, however, more explicit forms of interaction, where both humans and machines are active participants in the process. One of these forms of interaction is already present in our daily lives, through interactive AI like those in Apple's Siri or Amazon's Alexa, AIs that respond to human commands and assist in human activities, even while they continue amassing data on the human controller. (Kostopoulos, 2020) Other types of AI are being developed which aim to make the learning process of the AI go both ways, the humans learning from the AI and the AI from humans, this idea known as the "Wizard of Oz" technique, aims to make the AI more human-like by learning social and conversational cues from humans, as well as reacting to human emotional states, expectations and behavior. (Miller, 2019) The future of human/AI interaction seems to be more and more about a machine intelligence which can be indistinguishable from a human, passing the famous Turing test, which tests if a human can distinguish an AI from another human, while at the same time amassing an amount of data which would be impossible for a human to amass.

In the case of the Minder, as it's interaction with the interviewees required a direct conversation with each individual, considering all the different conversational outcomes that could arise from the conversation, its nature more closely resembles the second type of AI interaction mentioned above: the Minder, through its sets of questions, learns and adapts to each interviewee as the interview progresses.

However, the relationship built between AI and interviewee was designed to be anything but straight forward. Having been developed by major digital conglomerates, the reason why the Minder interviews the potential candidates is not the same as common AI, searching and amassing information. As the Minder already has access to all of the information the interviewees have shared across the parent companies' platforms, its real search is for its subjects' susceptibility to misinformation and coercion. Through its interactive experience that is presented at the end of each interview, the Minder seeks to "scam" each interviewee into believing they have done or are capable of doing something unspeakable, to which the Minder is privy to.

This coercion is only possible as each interviewee believes they are dealing with a somewhat common AI interviewer, a robot with a set of predetermined questions that presents itself with a formatted voice setting and a digital visual effect.

7. Proto-Personas

Bearing in mind that the group's project is a work of design fiction and looks to question future scenarios, when deciding on the target users and their actions within the proposed scenario, we developed a set of 3 proto-personas. In order to better demonstrate the different possible outcomes of the interaction, we chose to create three different characters, which in themselves were at the ends of the spectrum of emotion and reaction. This way, the relationships with the AI would be very different from each other and explore autonomous paths of the interview.

When defining the different characteristics of each proto-persona, we decided it would be best to base these on real-life people. This way the audience could easily identify the personality type on display and anticipate (or be surprised) by the outcome.

The three proto-personas created are:

The wealthy, entitled and digitally-savvy white, cisgender man who wants to use the platform for his own profit and for status. His profile was based on Jeff Besos and Elon Musk type personalities.

The non-binary, P.O.C. (person of color) activist who wants to use the platform as a way to understand what it is used for and how it can be subverted and exposed. The profile was influenced by activist and designer Sasha Constanza-Chock.

The fame-driven, white, female, lifestyle influencer that wants to be a celebrity and would be willing to do anything to reach her goal. Her profile is based on YouTube beauty bloggers such as Emma Chamberlain.

8. The use of moral dilemmas in the AI interview

As mentioned previously, there are already several institutional processes that heavily rely on AI systems and algorithms to analyze and sift through large amounts of data. These processes can, however, fall prey to issues of systemic biases related to established systemic racism, sexism, homophobia, and xenophobia that seeped into these new technological constructs. This project in particular decided to focus on the growing trend of AI-led personality and moral assessment interview processes, adapted to the social media enrollment process mentioned in the dystopian scenario.

The reason for this choice is closely linked to the wider possibility these systems have of being experienced by larger sections of the population in any part of the world, as the growing trend seeks to help HR departments across the globe select interviewees from large pools of candidates by applying predictive algorithm systems to the interview process.

Whether by analyzing answers to open-ended self-evaluating questions, by interpreting video-footage of the interviewees' reactions throughout the process or by examining the candidate's logical thinking when faced with a moral dilemma, the AI responsible for the interview applies a pattern analysis and standard response comparison set up in its programming. However, as we have established, these programs mirror implicit and explicit biases held by its programmers, they often are exclusionary as the questions posed often don't consider the special needs of candidates with disabilities or different types of response by people from different backgrounds, as illustrated in Tim Travers Hawkins' "Persona" documentary.

Even at its most basic level of analyzing the candidate's speed and logical organization of ideas, moral dilemmas and personality tests often serve as no more than a randomized test of lucky draw, as the candidate tries to match the correct answer to what pattern the AI is looking for. With little to no scientific basis and a hyper-inflated profile, personality tests and moral dilemmas are usually useful when seeking to destabilize candidates and elicit an off-guard response.

It's with this in mind that the present project seeks to frame its moral dilemma. Having already gathered data on the interviewee, the AI is not seeking information but rather an analysis of behavior and receptivity to its influence. When posing and presenting each candidate with hyper-realistic visions of morally dubious actions, under the pretext of a serious interview, the AI is seeking to throw the candidates off balance, luring them to pay attention to the images presented. As they try to make sense of the situation, the AI uses its technological device to trigger different sensations coupled with the aforementioned notion of fetishization of information that blurs the lines between what is real and what is not.

The critical moment will be the interview, conducted by the AI which will evaluate how much each candidate is worth to the platform – and to the exploitative goals of the AI and its parent companies.

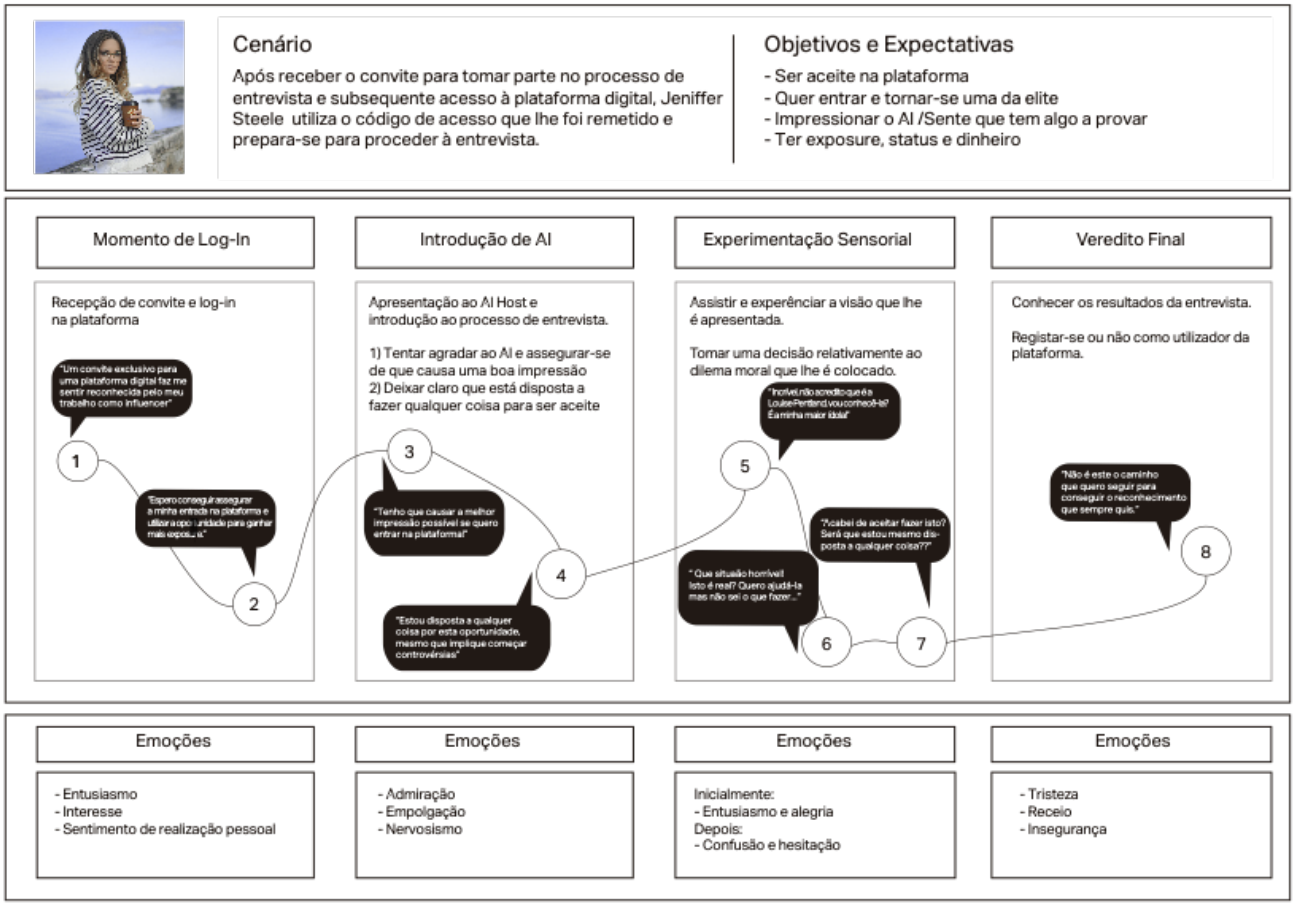
The Minder, due to the directives and preconceptions which inform its 'personality', is inherently biased. After a formal introduction on the part of the AI, in order to leave the user at ease, it will present a dilemma, in the shape of an ultra-realistic projection, in which the user will see themselves projected on the screen in the middle of an experience which they have never had and in which their actions leave them disturbed and in a state of confusion. All of this experience is enhanced and exponentialized through the earpiece technology which induced feelings of nervousness, irritation and excitement (as described previously) at strategic points in the dystopian narrative presented by the AI. The reactions to this experience are also monitored and evaluated by the AI and will contribute to the acceptance or rejection of the user in the platform, as it is in this way that the AI analyses each potential user, in conjunction with the information previously collected in other digital platforms.

As each interviewee watches the unique, hyper-realistic scenario unfold in front of them, their belief in the information presented to them by the AI, preying on their faith in data-driven technology, the AI manipulates their emotions in order to enhance their credibility. Once they have been coerced into believing they could do any of the unspeakable actions they witnessed the AI will know their level of receptivity to the information (true or not) the platform might feed them in the future.

9. User Journey

After creating the proto-personas and defining the crux of the interaction between the AI and each interviewee, we created individual user journeys to help create and polish each interaction in order to create the script that details the interviewees' experience with the AI. By understanding how each would react to the AI's questions and actions and how the AI would assess their replies, we were not only able to pin-point which moral dilemma would best suit and engage with each interviewee, but also which scenario would prove to be the best fit to showcase in the final film.

In the end, the proto-persona and the subsequent moral dilemma we chose to portray was the one belonging to Jennifer Steel, in her quest for fame even if it meant crossing her own moral threshold. As presented in the chart above, and in the individual scrips which were annexed to this paper, Jennifer's experience is filled with fluctuating emotions. As her eagerness to please the AI in order to en-



ter the Playground is exploited by the AI, she is already and unknowingly providing the Minder with the information it needs about her level of ease in accepting the false scenario it created.

10. Accessing the Interview

The whole interview process takes place in a purpose-built digital place designed by the Playground to serve as a sort of limbo where each interviewee awaits judgement by the AI. However, the first point of contact with the experience starts at their home's door, as an invitation is delivered.

11. Invitation

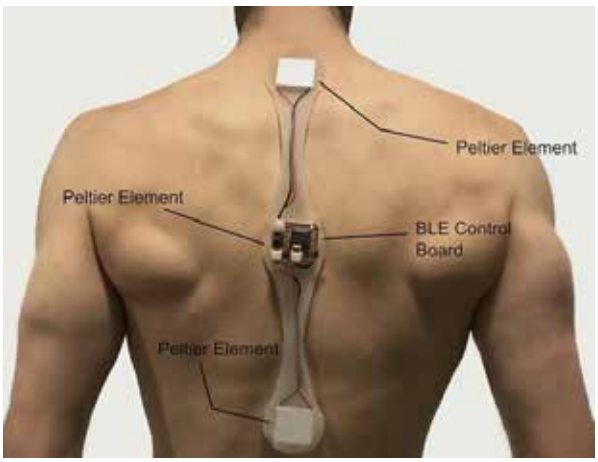
This platform selects its users through an invite and interview-only process. The reason for this system is to ensure the approval of members that are active on the platform for which they will be compensated for according to their levels of engagement and quality of produced content.

This way, the invitation is the first point of contact between users and the Playground platform. These invitations are sent directly to each possible user, under the guise of a Minder invite requesting the attendance to an interview. The invitation comes in the shape of a transparent acrylic box, with the platform's logo and the sentence "The Minder Invites you to Play" etched on the cover. The acrylic allows the user to discern the iridescent card insert in which the indentation of an ear with an earpiece on instructs the user to wear the object just as it is being worn by the prosthetic. After the user puts on the earpiece, the pc and earpiece will synchronize. The invitation is purposely devoid of text, except for the essential, in order to intrigue the user and also to leave them somewhat confused in what concerns the invitation.

12. Earpiece – Technology and Relevance

The project will feature the use of an interactive tool which will have a dual function: communication between the human and AI elements; and enhancing the emotional response of the human subject. While technology for communicating hands-free with devices is already ubiquitous and present in many devices of daily use, a device that is able to directly stimulate and affect reactions and emotions on the wearer is rather new. However, such technology is already being developed, in the form of wearables, which aim to use the human somatic and preconscious systems to both elicit and stimulate emotional reactions on human subjects. These tools work by influencing the mind of the user through the stimulation of processes which humans perceive but which are outside conscious control. (Jain, et al. 2020)

An example of this kind of wearable is the Frisson device, an experimental device which is applied down the spine of a human subject, and which stimulates a shiver that gives the user the feeling of an aesthetic chill, such as you would get from a particularly moving piece of visual art or music. The simple stimulation of the body creates in the mind the thought associated with the physical feeling, enhancing the aesthetic experience through a kind of "cheat". (Horowitz, n.d.)

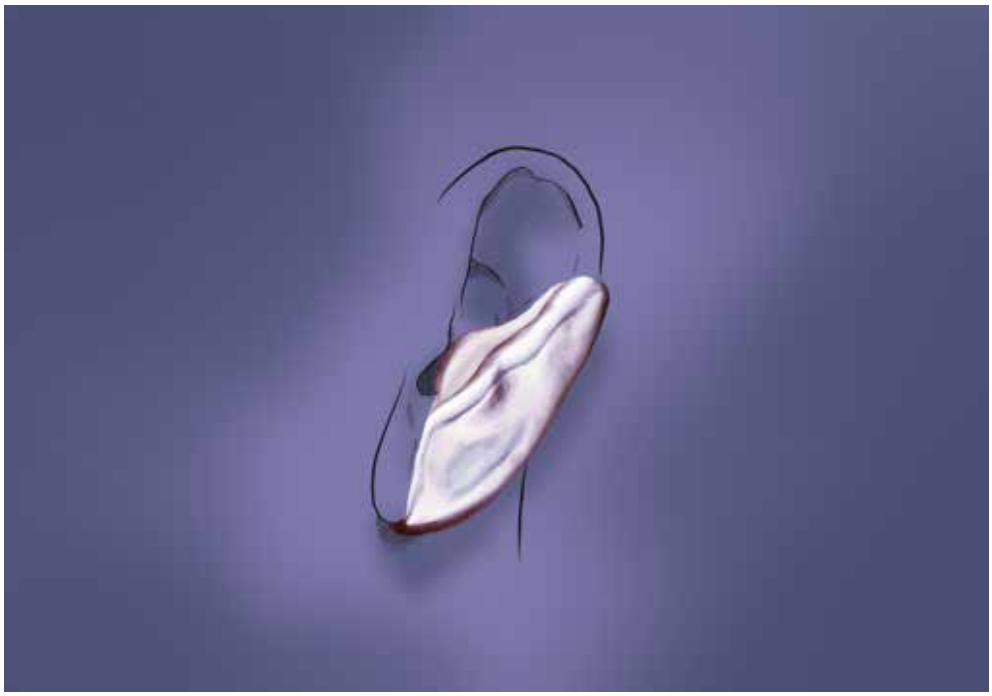


The Frisson prosthesis: a device delivering thermal feedback in a manner closely resembling to the internal chill, a traversing cold temperature from top to bottom.

The earpiece is the bridge between the user, the platform and the AI. By putting it on, the user starts a sync sequence between the earpiece and the computer which will redirect them to the Playground platform in order to be subjected to the interview with the AI. The earpiece is also used as the permanent contact object between the user and the platform, if the user is successful in their interview, becoming an object with a permanent presence on their ear, capturing data and ready to publish content or to perform other tasks in accordance with the user's intention.

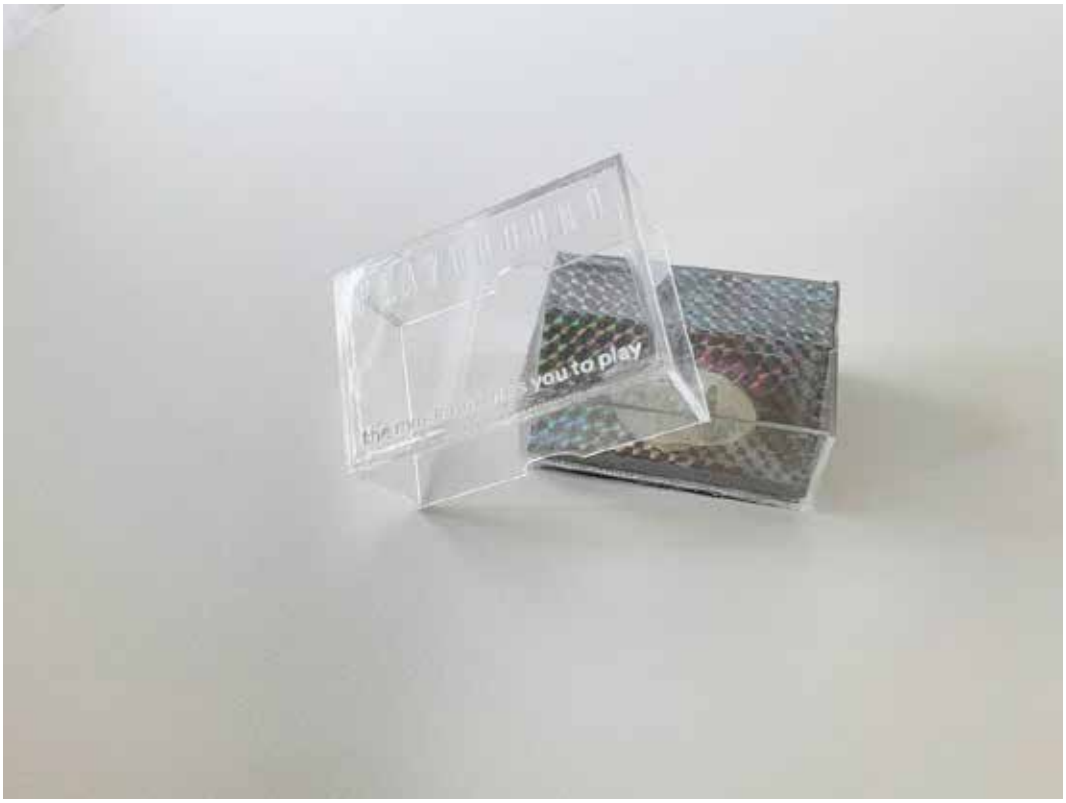
The earpiece is compose of a silicone body with a metallic finish, in which two microphones are integrated, one omnidirectional and another unidirectional, in order to capture both environmental noise and voice commands, an earpiece, a microprocessor with a wireless receptor for connection to the platform and processing of AI orders and, lastly, a network of electronic circuits which, in accordance with the orders of the AI and through electric discharges of different frequencies, can induce emotional states. This induction of emotional states through electric discharges is important in the interview experience, as a way to intensify feelings of nervousness, irritation and excitement necessary to make the experience that each user sees in the platform more real, encouraging more visceral emotions (examples of these reactions can be found in the annexed interview scripts). There is, then, a transposition from the digital to the real world in a daily and dissimulated way.

Interior schematics of the earpiece technological components

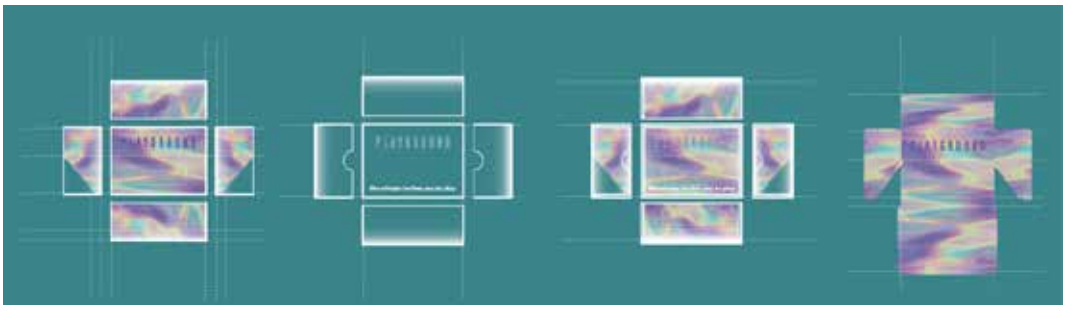


. Illustration of ear indentation with the earpiece on as it appears on the invite.

Sealed box in package



Open box at an angle



Detailed schematics of invitation box (interior cardboard insert and external acrylic box)

13. Interview Website

Finally, as the earpiece is worn by each interviewee, the device will automatically sync with the PC the interviewee is using and connect it to the web platform where the interview will take place.

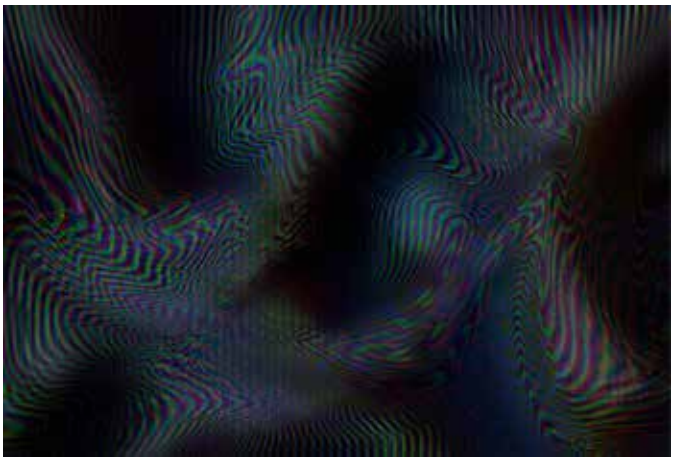
As the platform needed to house not only the AI itself but also the full hyper-realistic scenario the AI will present to each character, we soon understood the platform needed to be simple and easy to transition between both elements. As such, after a few initial screens depicting the identity of the Playground platform, the digital space where the interview takes place is an extended representation of the *Moiré* effect used for the AI.

This adaptation of the Moiré effect also allows for the appearance of the AI speech waves to come in and out of the digital space, creating a sense in the interviewee of not knowing if the AI is present or not until the sound waves begin to move.

After the initial interaction between the AI and the interviewee, the *Moiré* effect, which already displays a sort of glitch visual effect, slowly becomes more energetic and disturbed, as the AI presents the scenario.

The platform uses all the elements already selected to create the visual identity of the Playground as well as the physical appearance of the AI in order to maintain a coherent visual narrative that looks to create a seamless environment crucial to make each interviewee believe the content, platform and objects they interact with are designed for access to this platform, with no ulterior motives, and true. Just like the blind faith users nowadays place on brands, despite what the product actually offers, the different elements that build the interview experience strive to build this streamline look that never breaks the user's experience until it is already too late.

Screenshots of Website



Digital appearance of the AI

14. Conclusions

The bottom-line realization of this project is clear: as technology advances and as users' lives become increasingly more embedded with the technological environment one currently lives in, there is an ever-increasing need for regulation not only of these platforms and spaces where so many already spend a large part of their daily routines, but also of the technological field as a whole.

As many platforms or day to day objects can no longer be removed from daily life, there is a need to regulate and make more transparent the whole process that feeds the chain of production of these types of products but also the main element that feeds it - data. As it has been mentioned, current efforts to anonymize information are still falling short, as current algorithms can already decode secondary on formation about users that easily identify them without the need for a name or address. As these algorithms evolve past the point of its own coders comprehension - the "black box" phenomenon already mentioned in point 1.5 - and as machine learning develops its own logical system of understanding, current data-mining actions led by these conglomerates only serve to expose users to future harm.

Hence the importance of designing a very-near-future scenario led by an AI whose intentions are never really clear. The whole decision of not explaining how the hyper-realistic scenario is possible, or exactly why it is there in the first place, was made to mirror the opaque actions of deep learning algorithms, driven by directives and coded rules that put their parent company's profit and control above all.

Allied to this notion of manipulative algorithm, the project also makes use of the hyper-realistic scenario the character is confronted with to showcase how the absolute saturation of information paired with the willingness to accept algorithmic information as scientific canon can lead to an acceptance of this digitally constructed reality as truth.

A willingness that can be egged on through technology, illustrated in this project by the earpiece. Although an extreme way of controlling its audience, the truth is human relationships with technology already have reached a point not only of dependence but the current situation of being confronted with graphic content through one person's phone has already made most users numb to issues that would otherwise still shock its audience. As companies, institutions or even governments bombard users with extreme-tailored content, design through aggressive data mining, a whole "bubble-world" begins to wrap around its users, showing them content that affirms their points of view, blocking any possibility of disagreeable discourse and feeding their need for continuous content and entertainment.

In the end, the fetishization of information and content, led by algorithms that seek to deliver ever-more effective strategies of user engagement and attention, can become the perfect way for large conglomerates and institutions to deploy their profit and control agendas, cloaked by opaque digital systems.

References

Chia, H. 2019, *The "personality" in artificial intelligence*, in: https://pursuit.unimelb.edu.au/articles/the-personality-in-artificial-intelligence

Caballar, R., 2019, *What is the Uncanny Valley*, in: https://spectrum.ieee.org/automaton/robotics/humanoids/what-is-the-uncanny-valley

Dirik, I, 2020, *Why it's time to change the conversation around synthetic media*, in https://venturebeat.com/2020/08/12/why-its-time-to-change-the-conversation-around-synthetic-media/

Docx, E. 2013, *The Circle by Dave Eggers - Review*, in: https://www.theguardian.com/books/2013/oct/09/circle-dave-eggers-review

Hickman, L., 2013, *How algorithms rule the world*, in: https://www.theguardian.com/science/2013/jul/01/how-algorithms-rule-world-nsa

Horowitz, A., *Interoceptive Technologies: Inducing emotions from the body up*, in MIT Media Lab, at: https://www.media.mit.edu/projects/frisson/overview/?fbclid=IwAR1PSc6vudDlOiKJA9UOfFgpzYZgR0TE_nFPN3-6hxC_V2Vi5zaWB-

nykEzA

Jain, A. et al. 2020, "Designing Interactions Beyond Conscious Control: A New Model for Wearable Interfaces", in *The Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* vol.4, n. 3, 108.

Kara, H. 2019, *Book Review: Algoritms of Oppression: How Search Engines Reinforce Racism by Safiya Umoja Noble*, in: https://blogs.lse.ac.uk/lsereviewofbooks/2019/06/07/book-review-algorithms-of-oppression-how-search-engines-reinforce-racism-by-safiya-umoja-noble/

Kostopoulos, L., *Artificial Intelligence and Human Relationships: Expanding on the art piece "I can complete you"*, in: https://lkcyber.medium.com/3-types-of-artificial-intelligence-and-human-relationships-expanding-on-the-art--piece-i-can-901f198a1737

Leetaru, K., *As Orwell's 1984 turns 70 it predicted much of today's surveillance society*, in: https://www.forbes.com/sites/kalevleetaru/2019/05/06/as-orwells-1984-turns-70-i-t-predicted=-much-of-todays-surveillance-society/?sh-4800f2f211de

Miller, A. 2019, "The intrinsically linked future for human and Artificial Intelligence interaction" in: *Journal of Big Data* 6, 38. In https://doi.org/10.1186/s40537-019-0202-7

Riparbelli, V. 2020, *The Future is Synthetic*, in https://vriparbelli.medium.com/our-vision-for-the-future-of-synthetic--media-8791059e8f3a

Skloot, G. 2020, *Personality AI: What it is, how it works and why marketers need to know about it*, in: https://www.martechadvisor.com/articles/machine-learning-ai/personality-ai-what-it-is-how-it-works-and-why-marketers-need-to-know-about-it/#:~:text=Personality%20AI%20is%20a%20new,out%20of%20profiling%20your%20audience

Venkataramanan, M., 2014, *My identity for sale*, in: https://www.wired.co.uk/article/my-identity-for-sale

KRAKEN. The Newest Technology in The Wrong Hands

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Abstract:
Political manipulation in democracy in current times appears as a critical threat to public life, being essentially related to the growing consumption of the mass media. Since this consumption is increasingly digital, big data analysis, algorithms and artificial intelligence start to challenge truth and trust - the pillars of our democratic society.

The Kraken's software reports a probability of a near future in which, through the digitalization of the brain - pairing and transferring the mind, as a process where their reliable reproductions are kept - it will be possible to develop a database with the mind of every individual in society. It takes on a negative perspective of these technological advances since the mind is subject to different interpretations regarding the same matter, being fallible. It then portrays the opportunity to use this database of mind data to create false memories as a means of political manipulation in the future.

The project's main objective is to alert to possible consequences of the digitalization of the mind and, in general, of transhumanism, which can eventually be malicious and lead to the destruction of (our) humanity as we know it. In the speculative world in which the project is inserted, it is intended to denounce the possible disadvantages of digitizing the mind, raising questions around identity and consciousness.

Keywords: technology, politics, manipulation, false memories, mind uploading, interaction design

1. Projet's Background

1.1 Contextual Research

From an early stage, the idea/concern around the theme of consciousness and its relationship with memories emerged when approaching the transhumanist theory. Each group's member analyzed specific contents of the area, from brain prostheses that mimic the nervous system; a new artificial eye that successfully mimics the spherical shape of the natural instrument, managing to process light patterns in just 19 milliseconds – half the time required by a human eye – producing images that have greater contrast and lighter edges than those generated by a flat image sensor with a similar number of pixels; the existence of false memories; and digital immortality, raising the question of the future of memory, which, being an extremely important capacity for the human being, would have to be adapted to a situation of transition to digital, with all the consequent implications. [see the developed moodboard here]

Without memory, life would not be as we know it or idealize it. There would be no past or history of the species, it would be as if all the mistakes made over the millennia of our existence did not exist and, with this absence, there would be no learning, or any kind of knowledge, nor a sense of what is right or wrong, healthy or lethal to us. There would be no notion of the present and the formation of identity would not be possible, no one would know their tastes, interests, fears, not even family members, friends, or

companions. It would not be possible to imagine a future, as it is not possible to assume a more advanced time than ours without having a memory of what happened previously.

As previously mentioned, the construction of individual identity is formed through long-term memory and the learning and experiences of each one. According to philosopher Derek, *"a person is gradually transformed by his or her experiences and by memories that result from those, so that the complex and dynamic cognitive structure that is the self changes over time, until eventually little or no overlap may remain between the old self and a new one"*. (Parfit, 1971) When combined with extreme longevity or effective digital immortality – unlimited accumulation of data, resulting from retained experience records – the host's full identity would become unrecognizable over time. This accumulation of information would lead to an end to identity and consciousness.

The research made by the group members focused mainly on the development of the individual's identity, especially around the production of false memories and mind uploading. The first term refers to memories of events that did not happen as the individual remembers. As it can result from several causes, it tends to be a more common situation than most people believe. However, false memories are difficult to distinguish from real/true memories since the person believes entirely in the truth of what they are remembering. *"In general, the belief strongly rooted in the reliability of our memories is only shaken when we are confronted with an account that contradicts the facts we have described or the physical record of the original situation."* (Rodrigues, 2008). The second term, on the other hand, reveals to be the hypothetical concept in which the mind – the individual's subjectivity, consciousness, and empathy – is transferred as a copy from its biological form to an artificial computational structure.

In an era when political manipulation in democracy emerges as a threat to public life – since the consumption of the mass media is constantly growing – much of the ideological political thought has been mainly concerned with coercive interference in the lives of citizens. They try to manipulate them through influential speeches, incentives and lies that disrupt the regular and expected functioning of decision-making mechanisms, intentionally altering society's beliefs, thoughts and behaviors. It is in this context that the Kraken software emerges.

1.2 Kraken's Narrative

The project is accompanied by a speculative narrative, which led all taken decisions: In a speculative scenario – about 40 years in the future – the progressive adhesion of political parties to the Far-Right and the conduct by which they are governed to obtain power threaten the human species. Victória Lobo, an entrepreneur with a great impact on society, invests in the development and application of the brain digitization process, intending to digitally manipulate each individual's memories, thus reaching the maximum political power initially at the national level, and in a second phase, worldwide.

With a loyal team, she designs a software that allows the analysis of each of the minds digitized through a database, their manipulation, and the evaluation of the campaign statistics. This program can gather and evaluate effective manipulation techniques depending on the person you want to manipulate, allowing team members to choose the most appropriate and apply it, observing the changes in the victim's personality. These members are asked to also scan the brain, thus allowing politics to manipulate them too, unknowingly, if they choose to. This way, Vitória Lobo can even rule an extreme right regime, in which she has full control of all the people who have decided to adhere to the scanning of the mind.

Current users are asked to take the position of one of these characters, a team member called Virgílio Ferreira, simulating the manipulation process itself, looking for an informed reflection on the adversities of technological advances and, consequently, of Transhumanism.

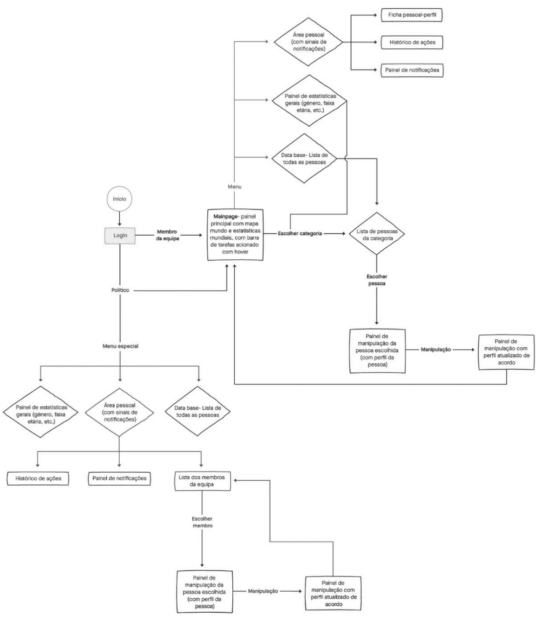
2. UX Design

After detailed research and the definition of the project, we started to design the user experience – to analyze the needs, objectives, capabilities, and limitations – through five essential points: personas (our characters), user flows, wireframes, quick prototyping, and user testing.

2.1 Personas and User Flows

In the development of the application, it was essential to start with a planning and organization process / information architecture / to define the functionalities of the application, anticipating the needs of future users. For that, the creation of characters was fundamental, in order to be able to foresee these issues. In addition, it helped to define the concept and the way the message would be promoted.

Throughout the project, unforeseen obstacles were encountered and had to be overcome which led to the alteration of previously established concepts and/or the definition of new functionalities. In other words, information architecture was constantly changing. [see more here]



User flows

2.3 Wireframes

After defining the bases of the project, we started to outline the software where it was possible to investigate practical questions of user experience. [see more here] technology's familiarity is also a parameter to be taken into account when applied to the specific project context. Attached is a hyperlink that refers to an in-depth analysis of the results. [see more here]

Wireframes

2.4 Quick Prototyping

A quick prototype was developed at inVision, where it was possible to verify the function of some of the most important elements of the application, but also its usability. In this prototype it was possible to represent the animations of the software and the links between the different pages. It is possible to already verify a specific language – an approach at the chromatic level and the different pop-up window formats. Decisions were carefully made so as not to compromise the user's experience. [see more here]

2.5 User Testing

For the User Testing phase, interviews were the chosen option, since it would allow a more in-depth and personal analysis of the prototype presented. In this way, it would be possible to observe possible doubts or hesitations in the interaction, to evaluate exactly its concerns, and receive advice and ideas that might not have been evaluated previously. A script was previously prepared that would serve as a basis for these interviews, with records of responses and comments, enabling the gathering of all data.

The results of these tests to users revealed that, in general, the interaction prototype is quite intuitive, with some flaws concerning some ambiguous icons – which did not convey the intended idea – and conflicts in some cases such as some pop-up windows and missing functions. There was also a set of useful suggestions for interactivity and operation mode. It became clear that

3. Production Design

3.1 UI Design

For the aesthetics of the designed platform, it focused on graphic elements that characterize the sci-fi universe, as the result of research on what is usually used in these interfaces.

For typography, we chose SF Pro Display font for the entire application, in order to provide homogeneity between the different pages. As far as color is concerned, a vibrant, bold, but simultaneously "moody" was chosen, which would convey a clandestine, mysterious, secret, almost illegal feeling.

Since the intention was to highlight the world map and the structures developed for the pop-up windows, it was decided to develop icons of simple character with clear and direct language, without compromising the user's experience. Three icons are visible at the bottom of the software —statistics, with an analysis of data from different countries and cities; the "home" button, which allows going back to the home page; and the "cloud", where one can access the digitized minds' database — and on the side, a reference to the team's chat.

3.1.1 Logotype

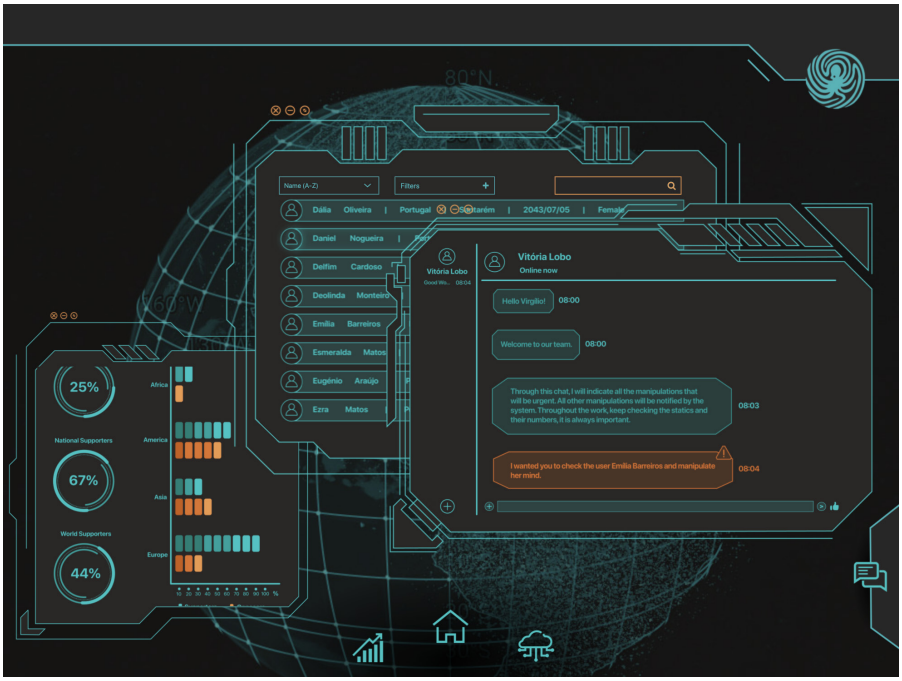
After a selection of names, it was concluded that Kraken was the one that best met the expectations of the entire project. According to Nordic mythology, Kraken was a giant mollusk that was believed to live in the deepest part of the Norwegian Sea, with robust tentacles capable of taking down any ship that dared to enter its territory, either by destruction or by sinking, through a whirlwind.

The symbolism and meanings generated around the octopus are contradictory – on the one hand, it is associated with flexibility, intelligence, adaptability; on the other, to mystery, illusion, strategy, and betrayal. In Portuguese literary culture, it is possible to verify some of these references and their connotation in the work of Padre António Vieira, Sermão de Santo António aos Peixes – "under this very modest appearance, or this hypocrisy so holy, the two great doctors of the Latin and Greek Church are openly testifying that octopus is the biggest traitor of the sea." Through his ability to camouflage, the author also reveals that not everything is what it seems, since this animal, unlike the chameleon, acquires other colors not to save itself, but to deceive its victims and attack them. Concepts such as malice, lying, betrayal, and dissimulation are, in the work, decisive elements in the analysis of the octopus.

The logo is based on these opinions: in the center of the symbol, the octopus extends, through its tentacles, in an evident format to the eyes of society, the most important identifying element of the human being, the fingerprint. This construction refers to the concept developed for the IxDilemma project, the manipulation of characteristics (by the group defined) essential to the human being — subjectivity, consciousness, and empathy — where questions of identity are questioned through the alteration or artificial implementation of false memories. [see more here]

Kraken Logotype

a predefined journey to explore it. This narrative makes the user assume Virgílio Ferreira's character, a young man who just started working at Kraken and is about to log into the software for the first time. In doing so he agrees to a list of terms and conditions that assure he is aware of the kind of manipulation he is asked to do and its effects. He is then greeted with a message from his superior on the team's chat asking him to manipulate someone. In completing the task the users are faced with how simple it is to manipulate a person and their identity through planted false memories thanks to this software. [try it out here]



Functional Prototype

3.2 Functional Prototype

In order to make a functional prototype it was necessary to firstly define its purpose, since it could be used for user testing or simply showing the multiple functionalities of Kraken's software. Having decided on the latter, the prototyping tool that proved more useful was Axure since it allowed having the most functionalities active and ready for exploring. Visually, Kraken's software is based on some research on interfaces used in sci-fi and action movies or video games, one of the examples being Mark Coleran's work in this field. Therefore, it maintains a clean and technological look, having straight lines and angles, specially on the pop-up windows, and two flat colors over a darker one to create contrast and improve the user experience whilst still keeping a simple, dark look. When current users first come in contact with this prototype, there's a high probability of them not knowing what it is about, since it takes place in such a specific and hypothetical situation. Using a narrative to guide the prototype's experience ensures the users can relate and understand what the software implies and means by going on

3.3. Proof Video Teaser

The teaser presented portrays the main focus represented in this project: the need to alert to the evolution of technology for use in the human body and mind and, consequently, its misuse.

In just over a minute, the transformation of the pillars of the personality (subjectivity, conscience and empathy) is demonstrated, through the mutation of the former organic forms to linear, straight and equal figures. A transformation that demonstrates the molding of everyone in the image of one, by the same ideologies and operational motives. The teaser seeks to accentuate the reflection intended with the project. [see more here]

4. Conclusion

One of the main goals when developing this project was to raise awareness to a seemingly utopic future in which new technologies could fall in the wrong hands, not unlike the future we are expecting now. The future proposed by this project portraits an irreversible situation, since, with mind uploading, the manipulation Kraken enables occurs simultaneously and automatically on the actual individual's mind,

not being noticeable at first, or at all, which would result in the molding of society and mischaracterization of communities as we know them.

This project is based on speculation, hypothetical scenarios and theories supported by research in order to fulfill the project's goal: to reflect and change the present so that in the future we don't lose sight of what makes us human.

The process was long as a coherent process should be, with many advances and setbacks. Most of the major difficulties were overcome as soon as our perspective on the main theme changed, since the theme itself was maintained (memory's importance on the formation of human beings' identity) whilst our approach changed: from a positive point of view focused only on the good prospects for this future to a critical and clear view of the possible consequences.

Through intensive research on the theme and the development of all kinds of essential objects to the creation of this dystopian narrative, the project started taking form and reaching the goals we deemed essential to portrait. The process was complex and involved learning new softwares in order to create the different elements that make up the project so that it was possible to reach an immersive experience, not only on the prototype but through the whole narrative and project.

Thus, after an intensive process, the final result was aligned with its original goals, seeking to instill reflection regarding the future, in general, and surpassing expectations in the potential it possesses to continue to deepen and explore this theme in its various aspects. This project confirms the importance of such an essential topic on the identity of human beings as individuals and as unique parts of society, proving the immense potential surrounding this approach to possible transhumanist futures.

References

Berger, T. (2001). Brain-implantable biomimetic electronics as the next era in neural prosthetics. *Proceedings Of The IEEE*, *89*(7). doi: 10.1109/5.939806

Bostrom, N., & Blackford, R. (2011). *H±*. Xlibris Corporation.

Bushwick, Sophie. "New artificial eye mimics a retina's natural curve".
Scientific American, 20/05/2020 https://www.scientificamerican.com/article/new-artificial-eye -mimics-a-retinas--natural-curve/

Callegaro, M. M. (2005). A construção de falsas memórias. Neurociências, 2(3), pp. 145-146. Obtido em https://www.researchgate.net/profile/Marco-Callegaro/public ation/264235658_44_Neurociencias_Volume_2_N_3_maio-junho_de_2005_A_construcao_de_falsas_memorias_Construction_of_false_memories/links/53d3b8db0cf2a7fbb2e9ea28/ 44-Neurociencias-Volume-2-N-3-maio-ju

Henriques, Julian F. (2019). *Digital Immortality*. In: Steve Goodman; Toby Heys and Eleni Ikoniadou, eds. AUDINT—Unsound:Undead. Falmouth: Urbanomic Media Ltd, pp. 161-164. ISBN 9781916405219 [Book Section] Retrieved 11 March 2021.

Mind. Retrieved 20 May 2021, from https://www.britannica.com/topic/mind

Mind Uploading. Retrieved 20 May 2021, from http://www.minduploading.org/

Palmer, A. (2021). How soon will we be able to upload our minds to a computer?. Retrieved 24 February 2021, from https://www.dailymail.co.uk/sciencetech/fb-5497467/HOW-SOON-ABLE-UPLOAD-MINDS-COMPUTER.html

Parfit, D. (1971). Personal identity. The Philosophical Review 80: 3–27.

Whitfield, G. (2020). On the concept of political manipulation. *European Journal Of Political Theory*, 147488512093225. doi: 10.1177/1474885120932253

Aeon - An Interactive Experience on Virtual Immortality and the Potential Consequences of Data Surveillance

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Abstract
This project consists of an interactive experience, concentrated in a website, that serves the purpose of provoking a critical reflection on the subjects of Virtual Immortality, Data Surveillance and the amount of personal information that we disclose online, specially to big companies such as Google and Facebook. The critical reflection and ethical debate that the project aimed to raise were made possible through the formulation of a futuristic scenario, that is fictional yet quite realistic, considering the advances on technology that might soon allow Virtual Immortality to be a reality. This futuristic scenario is provided by Aeon, the centre figure of the project and main object of its development. Aeon is the name of a (fictional) company that sells Virtual Immortality through the creation of a personal Avatar that is generated based on the digital footprint of the interested person. This Avatar is activated upon the death of the person in question and that Avatar proceeds to exist on the 'Virtual Space' also managed and made available by the company. This process is simulated in the interactive experience, to exemplify how one company can extract all the data that exists concerning the user as soon as the user accepts certain terms & conditions and privacy policies. While the main goal is to try to make the users question themselves about the quantity and quality of information that they disclose online, there are also questions that can be formulated in this experience about consciousness and moral values related to Virtual Immortality. Nevertheless, these questions and critical reflection are mostly dependent on the users and their own opinion on the matter.

Keywords: Interaction Design, Data Surveillance, Virtual Immortality, Artificial Intelligence (AI), Hypervigilance, Digital Footprint, Critical Thinking, UI Design, UX Design, Ethics.

1. THEORETICAL BACKGROUND

The term surveillance is usually applied when we talk about specific targets, such as suspicious and/ or wanted people. Yet nowadays, massive quantities of information about people and their activity are collected through Big Data Surveillance, even if this information does not seem to have any kind of use or value. However, that Data does have various applications and both companies and governments are already capitalizing it. Big Data is already used to feed algorithms that collect, organize and process information generated by users, and these algorithms have predictive power, as they can build patterns based on the user activity. Patterns like these are extremely valuable in marketing,

since they expose the users preferences, hobbies and their propensity to access determined advertisements, for example. Therefore, companies that are able to collect any type of Data that is valuable in this sense are usually most interested in selling this Data to other companies (especially ones that are trying to sell some sort of product). In this project, however, this specific application of Data Surveillance was not explored in depth, since it was mostly focused on the related subject of Virtual Immortality.

1.1 Virtual Immortality

'Virtual immortality is the theory that the fullness of our mental selves can be uploaded with first-person perfection to non-biological media, so that when our mortal bodies die our mental selves will live on.' (Kuhn, 2016).

The 'digital footprint' of a person comprises all the digital information that exists concerning that person, and it can be constructed by three principal sources: 'directed, automated and volunteered'. In the first, a human operator gathers data in a direct and purposeful way. In the second, data is obtained automatically and without the intervention of a human operator, through smartphones, for instance, that record communicates the history of their own use, transactions and interactions across digital networks'. In the last, data is disclosed voluntarily by people that use social media, websites and platforms of this kind (Kitchin, 2014). Knowing the sources of digital footprints, it is easily understood why they are one of the main catalysts of Virtual Immortality: they are the vehicle that assembles enough information about an individual that enables the creation of a persona from that information.

This digital footprint or legacy exists even after users die, and it includes social media, emails, online accounts, audiovisual records, digital property and much other content that becomes static once the user dies. This means that 'the growth of machine learning techniques to mine large data sets such as these' have an 'impact on society when the original subjects are living, as well as when the subjects are deceased' (Savin-Baden e Burden, 2019).

Our digital legacy can be divided in two formats: the passive and active. In the first, the receptor can read about a deceased person through some sort of digital memorial, that can be intentional (biographies and informative websites about deceased people) or unintentional (social media profiles, for example). The second format, that was explored in this project, consists of Virtual Immortality. It presents users the possibility of interacting with the digital footprint of a deceased person, through a chatbot or virtual human (avatar/persona). This interaction can be established in text, voice, or even video conversations and there are some companies already trying to create platforms that will be able to offer virtual immortality in the form of avatars /personas. Some of these companies are Eter9 (2017), Lifenaut (2017) e Eternime (2017) and they will be further discussed in the topic 'Related Work' (2.1).

Various studies reveal that this is a very realistic scenario and that it becomes more achievable each day, since the last big step is considered by many to be the attribution of consciousness to these personas. The question of consciousness is very important in the discussion of Virtual Immortality because it can determine whether virtual avatars can actually think, evolve and be conscious like a human being or not, being just an artificial intelligence.

1.1.1 The Debate of Consciousness

According to Robert Kuhn (2016), 'consciousness is the elephant in the room'. This author suggests that there is a great division in this matter, between being conscious and seeming conscious. Most authors, like Kuhn, defend that perceiving the difference between the two will be a challenge, considering that artificial intelligences, even if not conscious, will have the intellectual support to argue that they are, thus becoming, in fact, part of this debate. Most likely, it will be possible to attribute consciousness to an AI, but only if we first understand how human consciousness works. Just as we know exactly how a heart works and, for that reason, are able to replicate it, if we know how the brain causes consciousness, we'll be able to replicate it. Robert Kuhn proposes nine possible causes for the formation of consciousness, that he explores individually, determining if they are (or not) a possible door to achieve virtual immortality. To learn more about these theories and consciousness in AI, we highly recommend reading his 2016's work 'Virtual Immortality: Why the Mind-Body Problem is Still a Problem'.

Assuming that it will be possible to attribute human consciousness to a computer, as well as the digital footprint of a person, a question arises: from the moment the 'new person' (virtual and now able to evolve autonomously) is created, how long does it take for this new person to diverge from the original human? Will their personality, originally the same, start to differ? These questions cannot be answered yet.

1.2 Ethical Questions

Regarding the management of digital footprints, it lays in the hands of technology designers a lot of power and responsibility, concerning moral decisions. However, with almost no ethical rules or laws originated for the matter, the preoccupations seem to be left forgotten. Something as serious as immortality, virtual or not, raises numerous questions in complex fields such as religion and privacy, as well as implications resulting from the subsistence of an autonomous entity that supplants a person that no longer exists biologically and thus has no control over anything, anymore. Who will be in charge of these new virtual human beings? Will they be, in fact, conscious and autonomous to the extent of managing themselves? Only time will tell, but this project aims to trigger these questions on users and, hopefully, raise awareness to this matter.

2. DESIGN RESEARCH

In the thematic choice for this project lies a primordial idea that stimulated the rest of the conceptualization. First, when confronted with the topic of Data Surveillance (which we were immediately fond of), there was another thematic field that aroused interest: Intersectional Feminism. When brainstorming about those, we discussed the idea of a futuristic and hypothetical technology, with which was possible to design our babies before the human pregnancy, through a satirical approach, leading to the conclusion that it was still preferable to choose a male child in this society. From that, during our research on the Data Surveillance, we kept the desire to develop a company that requires the creation of an avatar, and posteriorly the concept of virtual immortality came to reify that.

After deciding to work on the issue of "virtual immortality", the first step to consolidate the concept was to create appropriate personas to sustain and legitimize our idea. To achieve this, four different personas were designed, to support different perceptions and approaches to the company (fig. 1).

Fig. 1 – Persona Rosa Martin

As we thought of different interests to justify our personas (for example, being the leader of a big company, having interest in high technology, seeking popularity and even family/emotional matters) we concluded that some would not get to the point of activating the product, since they would give up on it before their death. Later, as we started to work on the user journeys, regarding our personas, this was, once again, verified: we realized that this product requires a much larger quantity of interest than we initially expected, since it is a perpetual compromise (fig. 2).

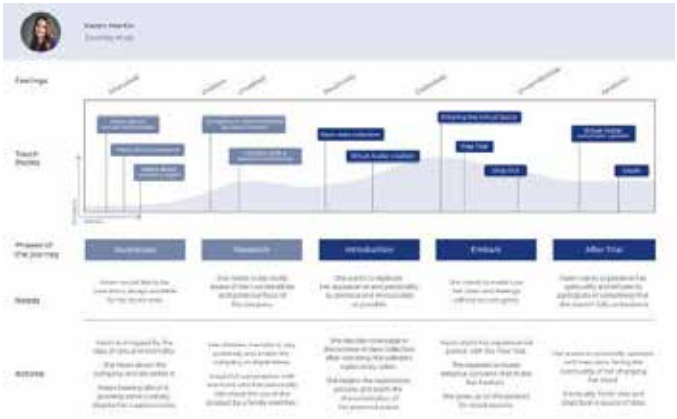

Fig. 2 – Rosa Martin's User Journey

When the first prototype was finished, the research moved on to user testing and this phase of the process was ultimately significant and crucial for the growth and solidification of the concept. Beyond testing specific functionalities of the website and the overall user experience in a very productive way, it manifested its greatest importance as the subjects asked questions regarding virtual immortality and the concept in general. All their concerns and anxieties about the topic served us as a guide to rethink and build up the concept to its full potential.

2.1 Purpose and goals

While developing this project, we gave special importance to the atmosphere we wanted this experience to achieve. That Immersive feeling, increased by the delicate thesis of the company, is the best way of leading the user to a deep reflection on the unconscious, reckless and trivial way we share our data, both voluntarily or through cookies. Furthermore, the concept itself and the simplicity of its resolution invite the user to think about the exorbitant capacity that contemporary databases reach, to the point where human beings cannot possibly understand them.

Additionally, our most evident goal is to introduce the user to the recent theme of virtual immortality, as well as provide another reflection on the dilemmas and ethical issues that surround it, originating an unsettling experience, which will, hopefully, concern the user about the way we approach this reality at vertiginous speed.

Finally, one of our deepest intentions is to criticize the ethical putrefaction intrinsic to capitalism, emphasizing indiscriminately the economic intentions of this company, that not even a dramatic content, like virtual immortality, can affect.

2.2 Concept

To achieve these purposes and goals, we developed, conceptually, a futuristic and dystopian scenario that explores the possibility of living forever through a digital reconstruction of all the data that we disclose online. It consists of a profitable entity whose product is virtual immortality and which works by creating a digital avatar. It feeds on our data to evolve into an exact reproduction of our personality and ourselves in general (physically and psychologically), which transcends space and physical limitations and can remain active (alive) after our death, in a virtual space designed by the company.

2.3 Target Audience

In order to enable the consolidation of this concept, it was necessary to predict an upcoming reality, in which the generality of the population would already have enough digital footprint to justify the existence of a company like Aeon, including the older strata of society. Considering this, Aeon's target audience splits into two major groups, characterized by two distinct factors.

First, the age: people up to their adolescence are not to consider, since this age range already has an intrinsic sense that they will live forever. Following up, adulthood is the starting point of Aeon's target spectrum, because, normally, that is the phase where people have already started to work towards their objectives and, therefore, started their biggest projects in life. Lastly, the elderly are also an important part of the target, as death is undoubtedly closer for them and our product offers a solution for that.

Moreover, the other factor is the financial status: as this fictional company serves the purpose of criticizing the capitalism, and sells something whose price is inconceivable, it is obvious that, in order to benefit from it, the client needs to pay the products of their lifetime work and so it is logical to target the fortunate ones that are able to afford it.

2.4 Related Work / Benchmarking

There are companies that are already actively trying to create computer applications which are predicated on the creation of avatar-level digital immortalisation.

ETER9 (https://www.eter9.com/)

Eter9 describes itself as 'a social network that relies on Artificial Intelligence as a central element' and that 'Even in your absence, the virtual beings will publish, comment and interact with you intelligently.' In this case Counterparts are the virtual avatars: 'your Virtual Self that will stay in the system and interact with the world just like you would if you were present. Your Counterpart will learn more with each action you take. The more you interact in the new social network, the more your Counterpart will learn!'

Such a Counterpart can continue to post and interact with others on the network, even after you are dead. However, this company fails to explain some parts of their functioning, since 'there is no obvious way in which you can access your own or other's Counterparts to see how well they are developing, if at all' (Savin-Baden e Burden, 2019). This lack of credible proof was also a goal of the present project, since we want users to think, precisely, about the legitimacy of this offered service of virtual immortality.

LifeNaut (https://www.lifenaut.com/)

LifeNaut.com is a web-based research project that allows anyone to create a digital backup of their mind and genetic code. The ultimate goal of their research project is to explore the transfer of human consciousness to computers/robots and beyond. It works though MindFiles, which are databases of personal reflections captured in video, image, audio and documents about yourself, that can be saved, searched, downloaded and shared with friends. Each account comes with an interactive Avatar that becomes more like the user, the more the user teaches and trains it to think like. Lifenaut is ruled by the Terasem Hypotheses which states that: '(1) A conscious analog of a person may be created by combining sufficiently detailed data about the person (a "mindfile") using future consciousness software ("mindware"), and (2) that such a conscious analog can be downloaded into a biological or nanotechnological body to provide life experiences comparable to those of a typically birthed human'.
(https://terasemmovementfoundation.com/).

Eternime (http://eterni.me/)

At the moment, Eternime takes the form of an app which collects data about its users. It does this in two ways: automatically harvesting heaps of smartphone data, and by asking questions to the users through a chatbot. The goal is to collect enough data about a person so that, when the technology catches up, it will be able to create a chatbot 'avatar' after the person dies, that the person's loved ones can then interact with. Ursache, the founder of Eternime, told Business Insider 'We collect geolocation, motion, activity, health app data, sleep data, photos, messages that users put in the app. We also collect Facebook data from external sources. The concept of Eternime is very similar to the narrative of the present project, but it is exaggerated in the project in order to, hopefully, make the user feel uncomfortable or at least suspicious.

3. THE PROJECT

3.1 Aeon

In order to make the experience realistic, a fictional company was created to fill the place of the entity mentioned before. It was named Aeon, meaning 'a power existing from eternity' or 'an indefinite and very long period of time' (in Oxford Languages). Aeon was designed to be a trustworthy company and yet not reveal too much to the users, since one of the goals of this project was to make the users realize they are very quick to accept terms and conditions, without fully understanding what they are about to disclose or undertake. Aeon presents itself as a big company with many users already enjoying the (paid) virtual space and, just like most big companies, it is here to sell.

3.1.1 Avatars

Virtual Avatars are created through collecting a person's digital footprint, which means that all the existing data concerning the interested user is extracted and attributed to

the user's Avatar. The person's appearance is also reflected in the Avatar, as it looks exactly like the person (even though Aeon offers the possibility to change some of the Avatar's physical characteristics, like the hairstyle, that is also changeable in real life). Avatars are constantly updated until the moment of their activation. The Avatars used in this project were retrieved from Replika, a project that allows the creation of a personal AI that helps users express and witness themselves by offering a helpful conversation. (https://replika.ai/)

3.3.2 Virtual Space

Aeon presents a Virtual Space where all the Avatars exist (in their digital form) and where they can interact with each other. The Virtual Space runs online and gives the Avatars access to all the information that also exists online. The users stay in the Virtual Space depending on the plan they choose.

Since building this virtual space was not a part of the project, we used recordings of an already existing project that had an aesthetic we found very adequate to represent our virtual space. This project consists of Data Visualization concerning 2016's USA presidential elections. (https://neovand.github.io/)

3.3.2 Chatbot App

Aeon also offers its users the possibility to communicate with their loved ones once they are gone in the physical realm and their Avatar is activated. Avatars are able to exchange written and voice messages with the people they want to talk to and their loved ones are also able to reach them whenever they want, anywhere, and this takes place in a Chatbot App, created by Aeon. Just like the Virtual Space, building this application was not part of the project, and it only exists conceptually to serve the narrative implicit on the service offered by Aeon, that not only allows someone to live forever but also to communicate with living people once they die.

3.2 Website and narrative

Nowadays, most consumers look for information about services and companies before making any major decisions related to them, especially when large amounts of money are involved. Establishing a company with a certain credibility and good, clean branding was the main preoccupation during the creation of the website. To guarantee that users enjoy the experience, we chose to create a simple, usable and easy to navigate website, instead of sticking to a prototype that's not dynamic.

Aeon is designed not only to provide a realistic representation of a company model website, but also to engage the user in an immersive experience related to one of the most controversial and tenebrous topics of humanity. To achieve this, it was necessary to experiment and to organize the platform cautiously, in order to find an ideal balance between the liberated and the closed courses of the website. In other words, the rhythm of the experience determines its efficiency, it could not be too permissive, but not too constraining as well.

Having this in mind, and to ensure better navigation within the website, we forged its structure into three stages. In the first one (fig. 3), users can consult a more informative page to learn about the company's concept and erase the biggest questions that they might have in mind a priori. Here, we introduce the visual identity, as well as the promotional video and the product itself, reaffirming the concept with two testimonial videos that close the page. This part of the website resembles a traditional business page, which purposely transmits comfort and assurance to the user.

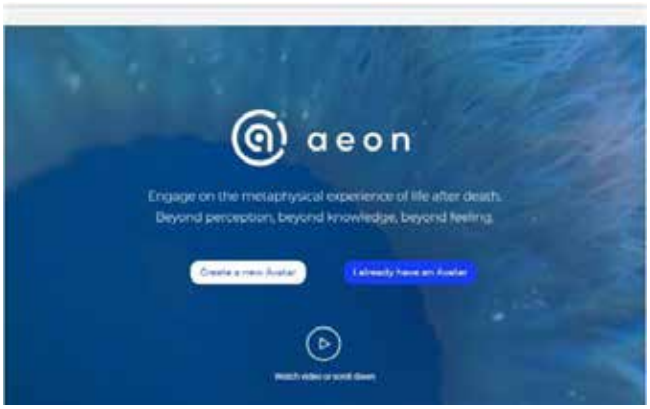

Fig. 3 – A screenshot of the landing page (first section)

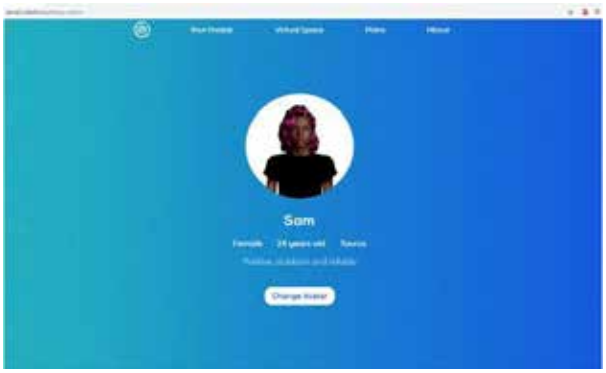

Fig. 4 – A screenshot of the avatar creation page (second section)

The other 2 sections consist of the avatar creation process page (that is a closed course, fig. 4) and the avatar management page, also called "free navigation section" (fig. 5). However, the second stage, the closed course, opposes the initial comfort, providing a claustrophobic and unstable feeling that goes on necessarily until the end of this phase, as the narrative itself emphasises that there is no return. New users are directed to the avatar creation page, in order to make a new account and create their personal avatar. After this process is completed, or in case a person already has an avatar, this user will be directed to the free navigation section.

Fig. 5 – A screenshot of free navigation page (third section)

3.3 Visual Identity / Interface Design

To create Aeon' visual identity, we chose to develop a more minimalist design with only the essential and most necessary elements of the product, getting rid of any excessive and therefore unnecessary components and resources.

One of the most important aspects to represent the company's identity is the colour and sensation it brings to the public. Since it conveys the idea of security, trust, stability and loyalty, we decided that blue would be the perfect choice for our website. The typographic choice and the construction of the logo refer to a clean and minimalist aesthetic (fig. 6).

Fig. 6 – Colour and typography choices evident in Aeon's logo

Finally, with the free navigation page, the experience ends. Nonetheless, it contains exactly the results of the previous stage, preserving that discomfort as the user explores the last details, which includes the FAQ and the "about the project"

In terms of content distribution, we opted to simplify the interface thus removing all unnecessary elements to ensure that users focus all their attention on the information presented.

3.4 Links

Aeon's Website: https://a1aeon.webflow.io/
Aeon's promotional video: https://youtu.be/rDkOk-trY1uo
Aeon's testimonial 1: https://youtu.be/P9rY-SXThs8
Aeons' testimonial 2: https://youtu.be/r7ZXxz_VNgw

4. CONCLUSION

While performing user testing, we realised the main goal of this project was achieved: people started asking questions they had never asked before. We observed a very curious audience, that not only was very interested in the project's concept but also quite unsettled by it. People started to raise questions about immortality and the ethical barriers related to the topic, since, for most people, being immortal was not a desire and never would be.

Some people promptly said they would like to live forever, but, when confronted with the implications of this reality, went back on their word. For some users, their main concerns were based on their inability to imagine living forever in a virtual form. However, for most users, their main concerns related to privacy and to what would be done with their data in case this scenario was real. Most people became aware of the quantity of information they disclose to companies and websites just by accepting terms & conditions they were too lazy to read, and every single user tested acknowledged to have experienced this without giving it much (if any) attention. Some users even said they did not care about what information was being collected from them, which only proves how unaware they are about the quantity and quality of data that is constantly being retrieved from them. This also reaffirms the pertinence of this project and we proudly believe to have made a difference in our users perspective concerning Data Surveillance, Virtual Immortality and their own precious privacy.

5. REFERENCES

Skeptic Magazine Vol. 21 No. 2 2016. https://www.closertotruth.com/articles/virtual-immortality-robert-lawrence-kuhn

Andrejevic, M. K. Gates. (2014). Editorial. '*Big Data Surveillance: Introduction*'. Surveillance & Society 12(2): 185-196. http://www.surveillance-and-society. org | ISSN: 1477-7487

Bainbridge, W., S. (2011). '*Avatars and Virtual Immortality*'. The Futurist, vol. 45, no. 2, 2011, p. 32-33. [World Future Society, Washington]

Captain, S. (2016). '*Have we uploaded enough data to create digital copies of ourselves?*' Published online in FastCompany.

Cebo, D. (2020). '*Scientific Relevance and Future of Digital Immortality and Virtual Human*'. International Journal of Research & Development, vol. 5, no. 12.

Humphries, C. (2018). '*Digital immortality: How your life's data means a version of you could live forever*'. Published online in MIT Technology Review.

Kitchin, R. (2014). '*Big Data and human geography: Opportunities, challenges and risks.*' Dialogues in Human Geography 3(3): 262–267.

Kuhn, Robert Lawrence. (2016). '*Virtual immortality: why the mind body problem is still a problem.*' Skeptic [Altadena, CA], vol. 21, no. 2, 2016, p. 26+.

Lyon, D. (2014).'*Surveillance, Snowden, and Big Data: Capacities, consequences, critique*'. Big Data & Society, 2014, p. 1-13.

Rahnama, H. (2017). '*Bots will soon be able to borrow our identities*'. Published online in VentureBeat, section The-Machine.

Savin-Baden, M., Burden, D. (2019). '*Digital Immortality and Virtual Humans*'. Postdigit Sci Educ 1, 87–103 2019.

Zuboff, S. '*The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power*'. New York: Public Affairs, 2019.

Shoshana Zuboff on Surveillance Capitalism (2019) – VPRO documentary https://www.youtube. com/ watch?-v=hIXhnWUmMvw

Harris, O. Brooker, C. (2016) 'San Junipero' in Black Mirror, season 3. Netflix.

Harris, O. Brooker, C. (2013) 'Be Right Back' in Black Mirror, season 2. Netflix.

Jonze, S. (2013) 'Her' (film). Sony Pictures Classics.

Virtual Reality applied to Exposure Therapy for Obsessive Compulsive Disorder

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Abstract
Obsessive-compulsive disorder (OCD) is a mental illness that causes repeated unwanted thoughts or sensations (obsessions) or the urge to do something over and over again (compulsions). OCD has various subtypes, including the fear of contamination in which individuals fear bacteria, germs, disease, or bodily secretions, and engage in clinically significant cleaning and avoidance rituals. In recent years, Virtual Reality (VR) has shown the potential to cure people suffering from anxiety disorders and OCD in Exposure and response prevention Therapy. The objective of this study is to create an application with VR for doctors which helps them during treatments. So, in this case, VR is one alternative to cure patients without using medication. This application simulates uncomfortable situations for people to overcome their obsession and compulsive behaviour.

Keywords Interaction Design, Obsessive Compulsive Disorder, Virtual Reality, Accessibility & Inclusive

Introduction

For the elaboration of this project, we started with a first research and exploration process divided into four fields: accessibility, inclusion, human technology, 17 UN Sustainable Development Goals.

Accessibility is now understood as an issue of human rights recognized in the laws of several countries in the world - the right to equal opportunities, non-discrimination, inclusion, and participation in all aspects of life in society.

Also refers to the possibility and condition of reach for safe, autonomous use of spaces, furniture, urban equipment, buildings, transport, information, and communication, including their systems and technologies, as well as other services and facilities open to the public, for public or private use for collective use, both in urban and rural areas, by persons with disabilities or with reduced mobility.

It is common to associate the theme of access to Cultural Heritage with 'disability, but today the approach must be taken in terms of 'disability.

According to the World Health Organization (WHO), respiratory diseases are among the leading causes of death and disability in the world. This classification is made considering the person's relationship with the environment and develops from two 'health' components, which are 'functionality' and disability.

Personality can also be predicted by other biological, social, psychological, and behavioural measures. Depression is a leading contributor to the burden of disability worldwide, with some evidence that disability attributed to depression is rising, particularly among youth.

Inclusion manifests principles that should guide the development of a society open to all, which leads to the con-

cepts of inclusive design and universal design. "This design concept has gained strength in parallel with the so-called inclusive society, one that aims to include the individual as opposed to their exclusion" (Introduction to the concept of inclusive design, practical applications in urban design and social/health equipment, AM Almeida Machado, 2006).
This concept consists of creating accessible and usable products and services capable of being used by as many people as possible, including children, the elderly, people with disabilities, the sick, the injured, or people who are disadvantaged by circumstances.

Therefore, it is intended to develop products or environments that allow its use by any type of people regardless of their capabilities. Its main objective is to eliminate social stigmas associated with products created exclusively for people without disabilities, giving people with disabilities the opportunity to participate in society. In this way, a designer must also be responsible for the positive impacts on people, the economy, and the natural environment, linking what is technologically possible to what is ecologically necessary, giving rise to new proposals that are appreciable in the social area, including solutions in sustainable areas, which must be the best possible, whether to innovate or modify a product, as we must create for a better and continuous life.

As Vezzoli and Manzini mentioned in their book Design for Environmental Sustainability (2008), "the role of design can be summarized in a general way, as the activity responsible for making something technologically viable and ecologically correct, and that must reflect the origin of significant new socio-cultural proposals."

Human technology refers to the present days where technology connects us like never, thus making explicit the degree to which we are defined and anticipated by others and how our ideas and identities no longer merely belong to us but are part of a great flow of connected individuals. More specifically, a crowd on the network becomes a stream of common consciousness.
Human nature is a broad concept, which nature has altered and expanded throughout history. Digital technologies increasingly challenge us to ask what it means to be creatures of language, self-awareness, and rationality.

Machines are not the human mind but are increasingly acquiring exclusively human attributes: reason, action, reaction, language, logic, adaptation, and learning. Above all, we think of ourselves as individuals, with rational minds and describe our relationships with technology on this basis. When asking what it means to be human, we are prone to think of ourselves as rational and individual minds, and to describe our relationships through technology on this basis: as distant "users", whose agency and freedom are a matter of skills and options substantiated. In conclusion, we have a moral obligation to start talking about our future and the role of technology in it. We are more than intelligence and data.

17 UN Sustainable Development Goals It is an Agenda for 2030, launched in 2015 by the UN (United Nations), consisting of 17 Sustainable Development Goals (SDGs) and 169 goals. A project that addresses several dimensions of sustainable development (social, economic, environmental) and that promotes peace, justice, and effective institutions. They are based on the progress and lessons learned from the 8 Millennium Development Goals (2000-2015) and work between governments and citizens around the world, a common vision for humanity, and a contract between world leaders and people.

Each of these objectives aims at improving people's quality of life as well as creating a climate of peace between nations. For that, it is necessary not only the creation of infrastructures that allow basic services, as well as the construction of an environment of equality among all. This agenda seeks to solve simple and complex problems.

The SDGs represent global priorities signed by more than 190 countries and define global priorities and aspirations. To that end, they require action on a global scale by governments, companies, and civil society. As an engine of economic growth, employment, and as a source of technology and innovation, the business sector has a fundamental role to play and self-interest in contributing to achieving the SDGs.

These are an opportunity for companies to enhance existing strategic actions and projects and implement new actions and projects that contribute to national and global goals.

ODS

We started this research with the definition of anxiety. Being an emotion characterized by feelings of tension, concern, and insecurity, accompanied by physical changes. When it persists, it interferes negatively and causes significant suffering, it is a pathology. It has been increasing, with a higher prevalence among women. Under normal conditions and when properly controlled, anxiety acts as a stimulant. In excess, it causes unnecessary suffering.

There are different types, the main ones being the following: Obsessive-compulsive disease, post-traumatic stress, Panic, Agoraphobia, Generalized anxiety, Social, Separation. That way we select obsessive-compulsive disease. It is an anxiety disorder in which a pattern of unwanted thoughts or intrusive, negative, and distressing sensations (obsessions) is created that leads to the adoption of conscious, standardized, and recurring behaviours to relieve tension (compulsions).

They have repercussions on people of all age groups and focus on a family, social and productive life. A simple negative thought triggers behaviours so that it does not occur. Due to this distorted sense of responsibility, the individual is distressed to realize that he is unable to ensure security. It mostly starts in adolescence or early adulthood, but it can start in childhood. It occurs more in the male gender – when manifested in childhood; and more in the female gender – the one in adulthood. The sooner the symptoms begin, the worse the consequences and causes will be.

User Research

For the accomplishment of this task, we elaborated two questionnaires to characterize personas. For the creation of the first questionnaire, we tried to make a small study about people in general, namely, to understand the levels of anxiety, even in people who do not suffer from it.

The objective was to start with general questions such as age, gender, current situation (occupation), whether they lead a healthy lifestyle (healthy eating and regular exercise) to get to know our users in a "basic" way. This research was carried out in 4 days - between March 19 and March 23, 2021, through the google forms platform with the collaboration of 1414 participants.

Among the participants, 97% (1358) were female and 3% (40) were male. The ages were between 16 and over 40 years old. The age group with the highest participation in the research were people over 40 years old and with the lowest participation, people under 20 years old.

We also assess the stress caused by relationships with others, as they are situations that cause medium stress or anxiety in most ages and genders. Family relationships, in general, cause more stress than relationships with others. Furthermore, a small percentage of people use therapy as a treatment, and the most common treatment is medication. It is necessary to create a second questionnaire for us to understand deeper insight into how this disease particularly affects each person. In this research, we obtained 9 female answers between 24 and 50 years. We kept from this questionnaire that the comfort zone of the participants is mostly family and nature.

The participants revealed that in some cases they feel anxious in times of facing the unknown, facing new situations, dangers at home and cleaning, untidiness, and someone messing up the personal objects of the people in question, particularly personal problems. This disorder in a behavioural way manifests itself in the participants mainly through repetitive behaviours or rituals based on actions. On an emotional level, patients with this disorder experience excessive worry, insecurity, and fear.

However, in terms of symptoms, the participants experience a racing heart, weakness, pain, and tightness in the chest, dizziness, a feeling of imminent death, and panic attacks. Few participants reveal that they are undergoing treatment and all treatments consist of medication. The situations that

aid in the treatment were divisions in the family's question, the alimentation, the relaxation techniques, and sport are efficient. However, medication is also helping.

How does virtual reality work in psychology?

Virtual reality can be defined as a dynamic and reactive composition with the virtual environment created by a computer and used for different modalities of human interaction. Baños defines virtual reality as a human experience, an advanced interface communication that allows the user to experience "other realities".

The use of virtual environments for the treatment of exposure is quite effective when compared to results with imaginary exposure. It is known that for habituation to occur more effectively, it is necessary for the patient to feel activation, both objectively (anxiety measured by objective instruments, such as physiological measures) and subjective (self-reported anxiety).

This is what the concept of synchrony says, which occurs when objective and subjective measures happen together during treatment, being more propitious to occur in situations of great anxiogenic activation (Rachman; Rodgson, 1974 cited by Wiederhold; Wiederhold21).

In imaginary exposure, there may be no immersion in imaginary scenarios subject to objective and subjective activation, since patients can more easily avoid cognitive exposure to scenarios, reducing the anxiety experienced and making habituation more difficult. In addition, virtual reality exposures provide greater changes in the sense of self-efficacy than imaginary exposure since virtual environments increase the possibility for the patient to successfully handle very anxiogenic situations.

In addition, exposure in virtual reality environments allows the filling of a gap: it allows the patient to be exposed to anxiogenic stimuli in a vivid way, as if they were real, when live exposure is not possible or anxiety about the real situation it is still extreme, making it difficult for the patient to enter or remain in the exposure situation, also decreasing the abandonment of treatment.

E-TOC

This project is developed in an application divided into two parts: one part designed to be used by the therapist – creation, planning, and implementation of therapy and another to be used by the patient – use of virtual reality mechanisms, such as glasses, heart rate meter, gloves that allow the capture of movements.

In this project, we have three different personas included as participation´s elements: Psychiatrists/Therapists who deal with patients with OCD (obsessive compulsive disorder); people with this condition: People who deal directly with someone with this disorder - family members and educators. Considering the particularities of each of these users, achieved through questionnaires carried out to them, it was necessary to develop two aspects of the project and, consequently, two user journeys. Although the application was created and developed with the patient in mind, with the development of the project, there was a need to support the therapist, mainly due to the planning and monitoring of the treatment.

In addition, since the treatments can usually last for more than two years, if the doctor must be absent, the process can always be temporarily carried out by another professional, although this situation is not recommended, especially by trust between therapist and patient already created. For this project, the creation of an application was considered, which allowed the implementation of exposure therapy and treatment planning, using Virtual Reality to simulate obsessions.

The program records the patient's heartbeat and allows psychologists to report on the patient's clinical status and consult their progress. During treatment, when the patient is ready to start treatment - the presentation of the videos begins. While using the Virtual Reality mechanisms - glasses, headphones, watches that measure the heartbeat, and the gloves or rings that capture the patient's movements, the therapist has access to all the information. This information includes a visualization of what the patient is seeing/doing in the virtual world, of the heartbeat, to understand when they are no longer normal, alternative video options, and the sequence if several videos are presented in

the same session.

Although the therapist cannot/should speak to the patient during treatment, he or she can draw notes on various conclusions throughout the process. In addition, the program lets you review the comments from previous sessions if there is one related to a problem not solved in the previous session, but which in the current one is important to reinforce. The advantage of this program being digital is that the acquired data can serve as a statistical and objective study about the disease and the treatment. The project even considers asking the patient about the use of his data only for statistical studies, maintaining anonymity.

Through the data collected, the system allows concluding such as average treatment times, the evolution of recovery, success, or failure cases, proving the effectiveness of treatment by exposure, general characteristics of the patient, such as age and gender, managing to understand the ways these two influence the same, among others. When inserted in the program, the data would be immediately organized and easy to study and interpret.

gh the possibility of interacting with a virtual environment in which he is inserted sensorially. The individual is passive to the images but with sensory elements available, he is not restricted to simple observation, there is the measurement of his beats and devices that transmit senses such as sensory bracelets or rings.

Conclusion

Virtual reality is not just to facilitate the work of doctors. The concept can also be explored to bring direct benefits to patients, either in the form of treatment or as a means of alleviating obsessive-compulsive disorder. Increasingly, virtual reality can function as a way of treating mental illnesses because three-dimensional images, in fact, make the brain interpret the virtual content as real.

The essential point of this work is to cure the patient throu-

References

D. Bhargava, H. D. B. (2020, 25 de junho). Anxiety Disorders. WebMD. https://www.webmd.com/anxiety-panic/guide/anxiety-disorders. Último acesso a 9 de Janeiro de 2020.

Cuf: Ansiedade. Cuf Website Oficial. https://www.cuf.pt/saude-a-z/ansiedade. Último acesso a 9 de Janeiro de 2020

Internacional OCD Foundation. What is OCD? Consultado

no dia 11 de março de 2021. Disponível em https://iocdf.org/about-ocd/

Internacional OCD Foundation (2021). What is OCD? Consultado no dia 13 de março de 2021. Disponível em, https://iocdf.org/about-ocd/

Mayo Clinic Staff (2021). Obsessive-compulsive disorder. Consultado no dia 13 de março de 2021. Disponível em https://www.mayoclinic.org/diseases-conditions/obsessive-compulsive-disorder/symptoms-causes/syc-20354432

Rethink Mental Illness. Obsessive-compulsive disorder. Consultado no dia 13 de março de 2021. Disponível em, https://www.rethink.org/advice-and-information/about-mental-illness/learn-more-about-conditions/obsessive-compulsive-disorder-ocd/

American Psychiatric Association (2021). What is Obsessive-compulsive disorder? Consultado no dia 13 de março de 2021. Disponível em, https://www.psychiatry.org/patients-families/ocd/what-is-obsessive-com pulsive-disorder

National Institute of Mental Health. Obsessive-Compulsive Disorder. Consultado no dia 13 de março de 2021. Disponível em, https://www.nimh.nih.gov/health/topics/obsessive-compulsive-disorder-ocd/in dex.shtml

Nogueira, Ianne Lima, Silva, Marcelle Almeida, Matias, Ítalo de Oliveira. O Uso da Realidade Aumentada e Virtual no Tratamento de Fobias. Universidade Cândido Mendes, UCAM Campos dos Goytacazes, RJ, Brasil. Consultado no dia 13 de março de 2021. Disponível em https://iftm.edu.br/wrva2011/cd/trabalhos/posters /93945/93945_1.pdf.

SIC Notícias (2 de Novembro de 2020). Viver na Sombra da Perturbação Obsessiva Compulsiva e da Depressão. SIC Notícias. Consultado no dia 16 de março de 2021. Disponível em https://sicnoticias.pt/especiais/saude-mental/2020-11-02-Viver-na-sombra-da-Perturbacao-Obsessiva-Compulsiva-e-da-Depressao

Gomes, Cema Cardona; Comis, Thiago Osório; Almeida, Rosa Maria Martins. (Dezembro 2010). Transtorno Obsessivo-Compulsivo nas diferentes faixas etárias. Centro Universitário Franciscano - (UNIFRA - Santa Maria/RS). Consultado no dia 18 de março de 2021. Disponível em http://pepsic.bvsalud.org/scielo.php?script=sci _arttext&-pid=S1413-0394 2010000300012

International OCD Foundation. Exposure and Response Prevention (ERP) Consultado no dia 18 de março de 2021. Disponível em https://iocdf.org/about-ocd/ocd-treatment/erp/

Fraga, Marcelo (25 Junho 2020). Pandemia pode desencadear TOC por limpeza, alerta psiquiatra. Encontro Saúde. Consultado no dia 18 de março de 2021. Disponível em https://www.revistaencontro.com.br/canal/saude/2020/06/pandemia-pode-desencadear-toc-por-limpeza-alerta-psiquiatra.html

Cordioli, Aristides Volpato (2014). A Terapia de Exposição e Prevenção de Resposta: Histórico, Fundamentos e Técnicas. Capítulo 2 do livro "TOC" 2a Edição: Artmed Disponível em: http://www.ufrgs.br/toc/images/profssional/material_didatico/a_terapia_de_exposicao_e_prevencao_de_resposta_fundamentos_e_tecnicas.pdf

Gomes, José (2007), Realidade Virtual. Origem, evolução, actualidade e desafios. Consultado em 28 de março: http://web.tecnico.ulisboa.pt/ist182015/cmul/in dex.html
Vital, Mariana Barros, (2012),Interaction in virtual environments with the upper body, Consultado em 28 de março: https://repositorio.ul.pt/handle/10451/9008?loc ale=en

BLog Oculus, VR for Heritage A tribal past finds its future. Consultado em 28 de março: A tribal past finds its future | Oculus | Oculus

Blog Oculus, VR for Culture Dining in 360° and what it means to be Asian in America. Consultado em 28 de março: Dining in 360° and what it means to be Asian in America | Oculus | Oculus

Blog Oculus, Five Years of VR A Look at The Greatest Moments from Oculus Rift to Quest 2, Publicado por Hayden

Dingman, 29 de março de 2021, Consultado em 28 de março : Five Years of VR: A Look at the Greatest Moments from Oculus Rift to Quest 2 | Oculus

Blog Oculus, Say “Hey Facebook” to Stay Hands-Free with Oculus Quest, 25 de fevereiro de 2021, Consultado em 28 de março: Say “Hey Facebook” to Stay Hands-Free With Oculus Quest 2 | Oculus

Blog Oculus, Latest Oculus Quest Update Fosters Developer Creativity with App Lab and Connects People with Messenger, 2 de fevereiro de 2021, Consultado em 28 de março: Latest Oculus Quest Update Fosters Developer Creativity With App Lab and Connects People With Messenger | Oculus

Blog Oculus, Oculus para criadores de conteúdo, consultado em 28 de março: Portal de criadores Oculus | Visão geral

Oculus, The Cinematic VR Field Guide In this section, The Jaunt Team provide an approachable field guide for better understanding everything from proper equipment to camera movement, lighting, and sound, Consultado em 28 de março: The Cinematic VR Field Guide (oculus.com)

Blog Cognitivo, Como a realidade virtual na Psicologia ajuda a tratar fobias?, 8 de abril de 2021, consultado em 28 de março: https://blog.cognitivo.com/como-a-realidade-virtual-na-psicologia-ajuda-a-tratar-fobias/

Blog The WorkPlace, Distúrbios Que Podem Ser Tratados Com Realidade Virtual, consultado em 28 de março: https://alegriavirtual.com.br/disturbios-que-po dem-ser-tratados--com-realidade-virtual/

Espaço clínico Cogistus, Terapia de Exposição Assistida por Realidade Virtual, consultado em 28 de março: https://www.clinicacogitus.com/terapia-de-ex posicao-assistida--por-realidade-virtual/

Clínica Mercolin, Terapia com Realidade Virtual, Prof. Dr. Marco Antonio Marcolin, consultado em 28 de março: https://www.clinicamarcolin.com.br/realidade-virtual/

Audit of open space design criteria In Neighborhood Residential Areas Case in Batisehir complex, Istanbul

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Abstract:

The aim of this study is to propose a checklist-based model that can be used to assess the open spaces of residential complexes, based on the example of Batisehir complex in Istanbul. International studies and reference points of view on this topic have been investigated in detail in order to identify criteria that can be used to evaluate this type of urban spaces. The main criteria that are believed to have an impact on the quality of open spaces are; Accessibility (sub-standards: building entrances, Pedestrian Circulatıon and Linkage System , way finding, Vehicular Access and Servıce Areas, Bicycle Paths, parking), open spaces (sub-standards: children's playgrounds, Restıng Area/ Seating Arrangement, sports Fields, Intermediate Fields) and urban furniture (standards Sub: floor covering, seating elements, lighting elements, trashes, signs & symbols and water elements), smart furniture (sub-criteria: smart HD camera, smart path and smart seating elements), safety and landscaping. The checklist that was created was tested in the open areas of the Batı?ehir complex, which is one of the largest residential complexes in Istanbul. The methods used in the study conducted between 2020-2021 were site selection, observation, photography and analysis. As a result of the study, it was decided that the design of open spaces, especially sports stadiums, should pay more attention and allocate more space in the design.

Keywords: Open space, Design criteria, Neighborhood, Residential areas, Batisehir complex

1. INTRODUCTION

Open spaces not only provide a pleasant and natural environment, but also improve the quality of life in urban areas and satisfy basic ecological functions ((Bolund & Hunhammar, 1999; Jensen , Guldager, person, Reeh, & Nilsson, 2000; Jim & Chen, 2008) In addition, much of the literature has reported that the appearance of the park has had significant effects on its neighboring residential areas ((Espey & Owusu-Edusei, 2001; GLA , 2003; Jim & Chen , 2010).

Many studies have emerged that focus on open spaces in residential areas and complexes, but most of them focused on the impact of these spaces on social interaction or user satisfaction without focusing on the design itself and design standards and trying to modernize them. Accessibility, open spaces, urban furniture, safety, and landscaping are the main considerations for outdoor spaces in residential areas quality.

Accessibility can be considered as the part that includes the necessary activities. The necessary activity is the involuntary activities such as working, studying, shopping, waiting, etc. In other words, people more or less carry out this activity, which is a part of daily life, and activities (Jienan, 2009) . Since this activity is mainly related to walking and movement, the road, walkways, entrances, stairways etc. becomes an essential element in relation to the necessary activities in the space. This criterion can be considered in design as a basis for other standards. Mobility and movement in all its forms within the residential complexes are arteries that feed open spaces and work to change the landscape and orientation towards different attractions in the design through a change in level or a change in direction. There is a strong relationship between spatial composition, accessibility and social interactions (Ferguson, 2007).

The criteria for accessibility in the external spaces of residential complexes have been divided into building entrances, pedestrian cırculatıon and lınkage system, legıbılıty, way

finding, vehıcular access, and servıce areas, Bıcycle Paths, parking (Lynch, 1960; kansoy, 1988; Özkan & Küçükerba□, 1995; T.S.E, 1997; Kurtulu□, 1997; Neufert, 1998; Suba□ı, 2000; Sayan, 2002; Jienan, 2009).

Open spaces are the vital part of outdoor spaces, in other words, they are places that include community activities. Community activity refers to the various activities in public places where people tend to interact. They include greeting, talking, children's games, recreational and sports activities, etc. (Jienan, 2009). If these spaces are comfortable and enjoyable, then people want to play, relax, stroll and be in the same place more. Naturally, it brings more diverse social activities, increases communication with residents, and creates an active atmosphere in the residential area, that is, an optimal use of spaces. These spaces are divided into children's playgrounds divided by ages (3-6), (7-12) and (13-17).) and various sports arenas according to different sports, rest areas and median squares (Seyhan, 1991; Ak□it, 1994; Kurtulu□, 1997; Ozkan, 2001; Lestan, Eržen, & Golobi□, 2014; Open Space Provision within New Residential Developments, 2015; Bonenberg, 2015; Salih & Ismai, 2017).

Urban furniture is a very important part in the design of outdoor spaces, as it is not only a piece of furniture, but also rich in expressions, attracting people's attention and interest easily (Jienan, 2009) . It can be one of the focal points in space in addition to the focused expression of the spirit of the place and through it the identity of the place can be expressed. Urban furniture has very wide ranges. The design criteria for floor covering, sitting elements, trashes, lighting elements, signs, symbols and water elements have been shown in this study (Harris & Dines, 1988; Booth, 1989; CCPT, 1990; Moughtin, 1992; Verhe, 1995; Stoneham & Thoday, 1996; T.S.E, 1997; Edward, 2019).

Smart cities are international projects and trends that have become frequently mentioned in recent years, so there must be smart housing complexes (not only smart homes, but also outdoor spaces), because the development of technology must be reflected in this field. *Smart urban furniture* is the next generation of furniture urban furniture, which has become available in the streets of some cities, but is not available in abundance in residential complexes. In this study, smart urban furniture was addressed, such as a smart high-resolution camera, smart path and smart seating elements (Hassanein, 2017; Ciaramella, et al., 2018).

Safety is an important criterion within the design criteria for open spaces in residential complexes, as it is considered a priority for the residents, as people will not be satisfied with life if security is not guaranteed and safety is threatened, therefore safety awareness is a crucial aspect in achieving environmental quality. Environmental quality is an important indicator for the study of livability as it has a direct impact on human activities and opportunities by creating a healthy physical and social environment (Bigio & Dahiya, 2004). Urban safety is one of the most influential factors in evaluating residential complexes. In this study, the design standards that achieve safety and modern technology that are adopted to achieve safety were addressed. (Giap, Thye, & Aw, 2014; Saitluanga, 2014; Kashef, 2016; Edward, 2019 ; Thanoon & Haykal , 2021).

Residential green spaces that not only constitute the main outdoor activity space for residents, but also the most widely distributed space with the highest rates of use in the urban green system. No element can replace it and without it the design loses its elegance and aesthetics. Green is often found as edges of the age, a natural barrier that gives privacy, green yards part of the site, etc. in residential areas. Although these green elements are separated, they still preserve the ecology of the space as a whole. It plays a positive role in the regulation of psychology and spiritual relaxation. The microclimate can also be modified to some extent. In this study, the crops, their cultivation, types and care were discussed (PAMAY, 1971; Çalı□, 2001; Jienan, 2009; Lestan, Eržen, & Golobi□, 2014; Bonenberg, 2015; Edward, 2019 ; Yang, Zhang, & Shi, 2019).

In this study, the design criteria were divided into five main sections. The criteria of these sections were separated in a table that was verified by testing it in the study and analysis of a residential complex considered newly established in Istanbul. The aim of the study is to establish open space

Figure 2. the neighborhoods of the study area

design standards for collective housing environments through analysis and study (Batissehir Project) based on research previously conducted internationally. Accordingly, five main factors were analyzed: accessibility, open spaces, urban furniture, safety, and landscaping.

MATERIALS AND METHODS

In order to achieve the aim of the study which is establishing modern design standards for open areas of residential complexes that are more in line with contemporary requirements in this study, the research objectives are as follows:

Objective of the Study

- Study and review international research and studies to know the standards for designing open spaces and its sections
- Analysis of the open spaces of the Batisehir complex with reference to the five main criteria that were identified by reference to references and studies
- Create a criteria checklist outlining design criteria for open areas and their impacts

Study Area

During the selection of the study area, the preference was made between residential complexes with large outdoor areas in different points of Istanbul province. Batisehir complex is located in Bagcilar district, Istanbul Valley complex in Sariyer, Istanbul halls complex in Kucukcekmece district. The main reason why Batı?ehir complex is preferred as a study area is the large size of its open spaces and its ability to meet the above criteria.

Batı?ehir Complex is located in Bagcilar, Istanbul, Turkey. It is a complex of 1148 apartments and can accommodate 15,000 people. With an area of 818,000 square meters. The green area covers 100,000 square meters.

There is a direct access from the TEM and Ba?ak?ehir North Marmara connection road in Batı?ehir, which is located at the intersection of the TEM Highway and Vatan Street. As well as direct access from E-5 for vehicle owners.

Figure 3. the map of the roads leading to the site

Data collection

In this study, a checklist was prepared by taking previously conducted international literature studies as a guide. The current state of (Batı□ehir complex) was later identified as a research area, and examined over a period of approximately one year between 2020-2021 using in-situ analysis and monitoring methods along with images and measurements.

RESEARCH RESULTS

More attention has been paid to the design and construction of apartment complexes in the recent period in Turkey. The tendency of people to live in these complexes has increased to provide a suitable and pleasant environment for their families, because the environment of these complexes has a very close relationship with human life. Meanwhile, it has a positive effect on the whole city. Therefore, creating a suitable living environment becomes a common goal. As the residential area is not only a place to live in, but also a place to practice activities for the residents, and the quality of the open areas in it contribute to creating a healthy community. Therefore, it is the responsibility of open space designers to strive to meet the needs of people, both physical and spiritual, in a contemporary way with the changes that are constantly taking place. This design should be based on correct and up-to-date information, so there is a need for study, information collection and analysis.

The study area was monitored and analyzed, measurements and pictures of the site were taken, then the observations were recorded according to the basic design criteria that were developed based on references and research. These pictures and notes of the study area are presented in tabular form below.

Table 2. Accessibility in Batisehir complex Assessment

	Good	*Average*	*Bad*
Building Enterances			
Use of hard materials on the floor	✓		
Adapting the entrances to the buildings for people with special needs	✓		
Non-slippery floor	✓		
Night lighting quality and suitability for people with special needs	✓		
The width of the entrance is not less than 915 mm	✓		
Isolated building entrances from vehicle entrances	✓		
Pedestrian Circulation and Linkage System			
Pedestrian paths are at least 4m away from residences	✓		
Distinction from vehicle roads	✓		
Safe for the elderly and people with special needs	✓		
Avoiding steep and sharp corners	✓		
Max. 8.33% slope		✓	
Min. 1.5m stair width	✓		
Having a vehicle road or parking lot exit from the main pedestrian axes	✓		
Orientation to visual attractions by changing scenery and level of vision	✓		
The presence of slopes next to the stairs	✓		
Easy access to the destination	✓		
Encouraging residents to walk	✓		
Legibility and Wayfinding			
The presence of landmarks, landscapes, or markings that can aid orientation	✓		
Direction signs readable over 20m		✓	
The presence of texture differences on the handrail wall and floor	✓		
Presence of at least 1 main transportation axis	✓		
Predictable road designs	✓		

Vehicular Access and Service Areas			
The presence of a service entrance in the buildings	✓		
Isolated from pedestrian and bicycle traffic	✓		
Taking measures to slow down traffic (landscape, lighting, paving changes)	✓		
Limitation of long corridors along roads	✓		
Limiting speed by bumps, sharp bends and narrow roads	✓		
Sufficient lighting so that speed reducing elements can be seen at night	✓		
Lighting pole height 3.5m	✓		
A lighting pole placement at 25m		✓	
The doors are not open on the road between the house and the street	✓		
Separation of roads to parks and playgrounds	✓		
Separation of playground equipment areas by bollards, fences or chains	✓		
Avoid entrances close to bends and hills	✓		
Parking spaces are not dominant over outdoor spaces	✓		
Presence of precautionary arrangements for insulation	✓		
20% separation for service vehicles and motorcycles		✓	
The presence of parking spaces for service cars			✓
Bicycle Paths			
Separation of pedestrian and bicycle paths		✓	
Separation of vehicles movement	✓		
The track width is not less than 1.8 m			✓
Parking			
Parking distance from homes is a max. of 50 m	✓		
Choosing a place isolated from open spaces	✓		
Allocation of 12.5 m for the car and its movement	✓		
Use of dense trees or low walls in parking lots for security	✓		

Table 2. Open Spaces in Batisehir complex Assessment

	Good	*Average*	*Bad*
Open Spaces			
Good use of open spaces (use and access to sunlight)	✓		
Multiple common areas for different activities of different users	✓		
Water sensitive design	✓		
Presence of visitor parking spaces that can be used for children's games			✓
Natural surveillance presence	✓		
Presence of the roof garden	✓		
Changed width at driveway entry slowing vehicles entering the site	✓		
Presence of open viewing areas for perception of security	✓		
Playgrounds			
Choosing a place away from the road and parking lots	✓		
The opportunity to monitor and protect young children aged 3-6	✓		
Use of rubber material on the floor (to prevent injury to children)	✓		
Separation of playgrounds according to age groups	✓		
7-12 years old children's playgrounds from the residences max. 300m distance	✓		
Providing enough space of 1-2m^2 for 7-12 years old children	✓		
Associating playgrounds and dwellings with an indirect relationship for the 13-17 age group	✓		
Providing enough space of 3-4m^2 for 13-17 year old children		✓	
Resting Area			
Presence of passive resting areas such as sitting, resting and watching	✓		
Per person min. Area not less than 2.7m^2	✓		
Service for all age groups	✓		
Roof cover for sun, shade and rain protection	✓		
Sport Filds			
5m^2 area per person (3m^2 of which is grass)			✓
2m^2 area per person for training			✓
Stadiums and residences max. 1000 - 1500 m	✓		
Football field 70 * 105 m	✓		
Basketball court 15 * 28 m	✓		
Volleyball court 9 * 18 m	✓		
Tennis court 23.8 * 23.77 m	✓		
Intermidiate Fields			
Presence of courtyards and common spaces between buildings	✓		

Accessibility

The entrances to the buildings are at the same level as the corridors and covered with anti-slip material, while the doors are made of transparent glass with a gray stripe to distinguish them for the visually impaired. The doors open automatically, which means they are suitable for users of rotating chairs and strollers. The entrances lack a Bariel line for the blind. Pedestrian roads are completely isolated from car parks and their channels, so that all lanes are designated for pedestrians within the open spaces. The pathways are not the same and do not cause loss for people with poor memory and children. The routes are constantly directed to different attractions and increased interest, and the change of level plays the largest role in this. Movement, parking and service cars are isolated from the exterior design of the complex, as the complex is surrounded by a service street that secures the service to the complex, where service cars and school delivery cars provide service and delivery through it. Do not enter the complex. All gates, entrances and exits of the residents' car parks are connected to this street. This street is called Batisehir Street. For bicycles, one lane surrounds the sports field, 1 m wide. The car parks are completely isolated from the open spaces of the complex and linked to them by stairs covered with transparent plastic cabins distributed in different places in the open spaces (Table 2).

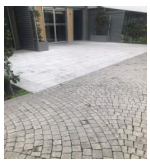
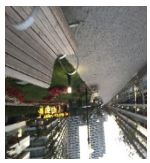
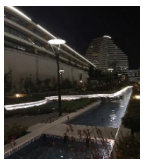
Open Spaces

Children's playgrounds are far from the street and isolated from the movement of cars. Children's playgrounds are classified according to ages and their distribution in the complex follows this classification. Children's playgrounds for this category are divided into 4 places in order to be close to all buildings. They are mostly surrounded by wooden fences and sometimes surrounded by plants. The floors of these playgrounds are made of shock-absorbing rubber. Children's playgrounds for this category are distributed over 4 different areas of the complex to be close to all buildings. Children's playgrounds of this category are centralized and grouped in one place in the middle of the open spaces of the complex. Seating areas are distributed in various places in the complex, often located near children's toys and water elements. Seating is partially shaded. Sports fields are located in the middle of the open spaces. The running tracks are distributed over 3 different regions. There are stationary sports near the games for children from 3 to 6 years old. In this complex, the intermediate fields are not clearly visible, because the design of the buildings is circumferential, but these spaces are located between some of the buildings.

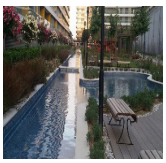
Street Furniture

The floors are covered with coarse and smooth stones. It is used rough for driveways and slopes and smooth (non-slippery) for building entrances and stairs. Children's toys, jogging tracks and some rest areas are covered with shock-absorbent materials as mentioned above. The main material it is made of is wood. The iron legs are not slippery and matte at a height of 45 cm from the ground. Most of them are equipped with side and back struts, and some without struts. Some places are shaded with pergolas in order to provide relative protection from the weather conditions. Light poles are regularly scattered on the walkways, and solar lights have been installed in the gardens. The sports fields are brightly lit, while the seating areas are dimly lit. Trash cans are often located near the benches and are spaced approximately evenly in the aisles, installed at a height of 50 cm from the floor. The signs in the open spaces are mostly indicative. They are installed at a readable medium distance. The letters are engraved in black, the warning signs are few and are installed on the ground mostly. This complex contains two types of elements of stagnant and moving water. The complex contains 3 swimming pools distributed in different places, each pool has its own facilities. distributed the moving water elements in the interior spaces are abundant and take different forms. The complex does not contain any type of smart furniture (Table 3).

Table 3. Street Furniture in Batisehir complex Assessment





	Good	*Average*	*Bad*
Floor Covering			
Non-slippery material	✓		
Enable seeing the boundaries of the earth	✓		
The materials used for coating secondary road surfaces are different from each other	✓		
The visually impaired areas are made up of three different materials		✓	
The difference in the color of the surfaces to facilitate the detection of the road for the visually impaired	✓		
Surface coating with neoprene	✓		
Sitting Place			
The seating seats are made of non-slip and glossy materials	✓		
Choosing the right place for seating	✓		
For wheelchairs to dock next to the seating, min. 90cm place	✓		
Seat height 45 - 50 cm	✓		
The presence of side supports for the seats		✓	
Seating seats protected by umbrellas or roofs	✓		
The presence of guide signs to indicate the transition from the walking area to the seating area	✓		
The presence of litter boxes near the seating seats	✓		
Lıghtıng Elements			
Provide a guide line of lighting for the elderly and the disabled	✓		
Accuracy in choosing lighting elements to suit people with special needs and the elderly	✓		
The presence of lighting along the road and at obstacles	✓		
Lighting installlation according to the type of activities and the movement intensity in each area	✓		
The presence of dim lighting in some places	✓		
The presence of intense lighting at road intersections	✓		
Trashs			
Trash bins do not intersect with the movement path	✓		
Installed at a maximum height of 90 cm	✓		
The possibility of using trash cans with one hand by the disabled	✓		
Litter boxes are circular in design and do not have sharp edges	✓		

Signs and Symbols			
Information is clear and easy to read	✓		
It can be read by all people, including the visually impaired		✓	
The ability to distinguish upper and lowercase letters		✓	
Using colors as semantic symbols in panels	✓		
The letters are embossed, not printed	✓		
The presence of tactile reading panels for the blind			✓
The presence of audio notifications in some places for the purpose of warning the blind			✓
Panels are at eye level	✓		
Signs and symbols are everywhere	✓		
Water Elements			
Stagnant Water Elements			
Swımıng Pools			
Compatible with the exterior design	✓		
It stands out in space and is easily perceived	✓		
Attractive element	✓		
It occupies a central position and forms an important part of the exterior design decoration	✓		
The number and size of swimming pools correspond to the population of the complex	✓		
Moving Water Elements			
It has a positive effect on the perception of the place	✓		
Exploitation of natural factors in the movement of water	✓		
Distributed in the exterior design in harmony with the green spaces and other activities in the place	✓		
Smart Urban Furniture			
Smart HD Camera			
The presence of a smart camera			✓
The presence of warning systems against penetration			✓
The presence of surveillance cameras	✓		
Smart Path			
Having a smart path			✓
Smart Seating Elements			✓

Safety

As already mentioned, there is isolation between pedestrian and vehicular traffic, the lack of parking spaces in the open spaces of the complex, due to the impossibility of their entry. The activities in the interior design were distributed to different places in the complex in the form of focal points to facilitate observation. The complex has 10 pedestrian gates, each entrance is equipped with a guard room and surveillance with cameras, The gates are opened through a device to identify the population cards of the complex. As for the car parks, they are monitored by cameras, guard rooms, and the entrances to the parking lots are equipped with a system to identify the car regulations for residents (non-residents are not allowed to enter the parking lots) (Table 4).

Landscape

10 thousand species of plants were planted in the outer spaces of the complex (Egeyapı, 2021). These plants are automatically watered every morning by sprinklers in the summer (Table 4).

DISCUSSION

According to the above table, accessibility, open spaces, urban furniture, smart urban furniture, safety and landscaping were determined for the study.

The site generally lacks a Bariel line for the blind and that some slopes are more than 8.33%, and this poses a danger to wheelchair and pram users. Direction signals cannot be read from a distance, which presents an obstacle for blind people to find their way. As for the lighting poles, they are not within the required distance, especially on the service street.

As for the service street surrounding the complex, it is necessary to commend the design solution that provided complete isolation between vehicular traffic and pedestrians within the open spaces, but this street is considered narrow and crowded due to the services it provides to the entire complex as it lacks serviced parking spaces.

The bike path is narrow and short and not commensurate with the size and density of the population of the complex but it should not be overlooked that the open spaces do not penetrate the streets and do not have car parking, so all the paths in the complex are for pedestrians, bicycles, buggies, wheelchairs and skating.

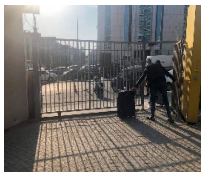
Most of the design criteria were taken into account when designing children's playgrounds for the age group 3-6 and 7-12 years old, but children's playgrounds for the age group 13-18 years are considered insufficient compared to the population density. From the complex, and because these playgrounds are commonly used by adults as well, they are insufficient as playgrounds for children of this age group, sports fields for adults and the same for training areas.

The floors are fine and as per specifications, but gray is the only color approved for floors, driveways, stairs, and ramps, so the visually impaired may not recognize it. As for seating, there are some seats that do not have armrests. These seats are not comfortable. As for the lighting elements, it should be noted that the outdoor spaces are well lit. Crowded areas such as playgrounds and cafe area are well lit and relaxation areas are dark and quiet. Sign boards and symbols are distributed in the complex, but they cannot be read from a distance and letters cannot be distinguished by the blind, and some warning boards are also installed on the floor, making them difficult to notice. Water elements have been widely adopted in the exterior spaces of the complex. They are abundant and add aesthetics to the place. It must be noted that the complex is devoid of any kind of smart urban furniture, and this is disappointing.

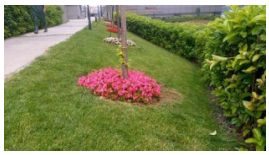
The security standards in the complex are good, the entrances and exits of the complex are controlled from entering outsiders, and the outside spaces of the complex are monitored with cameras throughout the day. However, night activities cannot be confined to one place due to the large area of the complex.

The plants vary in the external spaces of the complex, and different types of trees and plants have been planted, which add beauty to the place and do not require much watering and are not seasonal. However, through a simple tour of the site, it is noted that some areas need maintenance and attention. Plantings do not provide privacy, especially for houses on the ground floor that have their own gardens fenced with plants, and the administration of the complex does not encourage the residents to plant.

Table 4. Safety and Landscape in Batisehir complex Assessment



Safety	*Good*	*Average*	*Bad*
The residential complex is surrounded by a wall	✓		
Exterior fence design carefully to allow permeability without strangers entering	✓		
The presence of clear and specific portals	✓		
Equipping the gates with population identification systems through project-specific cards	✓		
The gates are equipped with cameras on each side. These cameras are linked to the monitoring room	✓		
In each gate, a room or cabin must be provided for the guards so that the gates are guarded throughout the day	✓		
Use implants that not aid penetration, such as spiked or vision-blocking implants	✓		
Centralized night activities for easy monitoring and supervision		✓	
Keep the street away from the project and not penetrate it	✓		
Separation of car and vehicle traffic from pedestrian traffic	✓		
Separation of car parks and their isolation from pedestrian traffic, whether by a wall or by plants	✓		
Equipping the entrances to the buildings with identification devices for the residents of the complex	✓		
Providing car park entrances with a plate recognition system for residents' cars	✓		

Landscape	*Good*	*Average*	*Bad*
Selecting plants appropriate to the local setting and which will survive well under local and particularly subtropical/tropical conditions	✓		
Considering watering requirements	✓		
Considering maintenance requirements		✓	
Considering height and privacy versus surveillance		✓	
Providing landscaping that recognises seasonal and diurnal differences (e.g., diversity throughout the year, flowering plants at different seasons)	✓		
Encouraging resident participation in on-site gardening and maintenance where feasible			✓
Recognising that thorny shrubs have their uses in deterring entry but may be impractical around play areas and attract litter	✓		

CONCLUSION

The criteria tested in the study area indicate that the open areas of the complex scored well in most of the criteria, but there are deficiencies in other criteria that had to be taken into account in the design.

REFERENSES

Ciaramella, A., Bellintani, S., Savio, L., Carbonaro, C., Pagani, R., Pennacchio, R., . . . Thiebat, F. (2018). *Smart furniture and smart city.* Italy: IOP Publishing.

Jienan, y. (2009). *RESEARCH OF LANDSCAPE DESIGN IN RESIDENTIAL AREA Vanke Fifth Garden & Crystal City in China Bo01 of Western Harbor in Sweden.* The European Spatial Planning Programme. Karlskrona , Sweden: Blekinge Institute of Technology.

Jim, c. y., & Chen, w. y. (2008). *Cost-benefit analysis of the leisure value of urban greening in the new Chinese city of Zhuhai. Cities.*

Kelbaugh, D. (1997). *Common Place: toward Neighborhood and regional Design.* Washington: University of Washington Press.

Lestan, K., Eržen, I., & Golobi, M. (2014). The Role of Open Space in Urban Neighbourhoods for Health-Related Lifestyle. *International Journal of Environmental Research and Public Health*.

Rudlin, D., & Falk, N. (1999). *Building the 21st Century Home, The sustainable urban neighborhood, Architectural Press.* England.

Salih , s. a., & Ismai, s. (2017). Criteria for Public Open Space Enhancement to Achieve Social Interaction: a Review Paper. IOP Conference Series: Materials Science and Engineering.

Sarkissian, W., Bateman , R., Hurley, B., & Young , A. (2013). *OPEN SPACE IN MEDIUM-DENSITY HOUSING GUIDELINES FOR PLANNING AND DESIGN.* Australia: Sarkissian.

Thanoon, M. G., & Haykal , H. T. (2021). Influences of Environmental Quality and safety & security on the Liveability of Residential Complexes in Erbil City. *ZANCO Journal of Pure and Applied Sciences*.

Yang, J., Zhang, F., & Shi, B. (2019). Analysis of Open Space Types in Urban Centers Based on Functional Features. E3S Web of Conferences 79, 01009.

Ak it, n. (1994). *A Research on Non-Residential Use and Standards in Mass Housing Planning.* istanbul: Unpublished Master's Thesis, Mimar Sinan University Graduate School of Natural and Applied Sciences.

ASI. (2001). *With SN 521 Norms Accessibility Guide – Structure for Persons with Disabilities.* ASSOC AT ON SU SSE DES NVAL DES, istanbul.

Bigio, A., & Dahiya, B. (2004). *Urban Environment and Infrastructure Toward Livable Cities.* Washington,DC 20433 USA: the International Bank for Reconstruction and Development/THE WORLD BANK.

Bolund, p., & Hunhammar, s. (1999). *Ecosystem services in urban areas.*

Bonenberg, W. (2015). Public space in the residential areas: the method of social-spatial. *Poznan University of Technology, pl. M. Sklodowskiej-Curie 5* (s. 1720 – 1727). Poznan: Procedia Manufacturing.

Booth, n. k. (1989). *Basic Elements of Landscape Architectural Design.* Long Grove, Illinois.: Waveland Press Inc.

Çalı, A. .. (2001). *Creating a Mass Housing Model with Physical, Visual and Social Interaction Features.* Ankara: Ankara University, Faculty of Science, Department of Landscape Architecture, Master's Thesis.

CCPT. (1990). *CENTRAL CO-ORDINATING COMMITTEE FOR THE PROM.*

Cooper Marcus, C. (2003). Shared outdoor space and community life. *Places: A Quarterly Journal of Environmental Design*, 15 (2): 32-41.

Edward, F. (2019). *Regenerating Public Space in Residential Areas Planning and Design Proposal for Oxhagen Residential Area, Kalmar.* Karlskrona, Sweden: Faculty of Spatial Planning, Blekinge Institute of Technology.

Egeyapı. (2021). *Batisehir*. https://www.egeyapi.com/batisehir adresinden alındı

Espey, m., & Owusu-Edusei, k. (2001). Neighborhood parks and residential poperty values in Greenville, South Carolina. *Journal of Agricultural and Applied Economics*, 33(3): 487-492.

Ferguson, p. (2007). The streets of innovation. In: Proceedings of 6th International Space Syntax Symposi-

um., (s. 16). istanbul.

Giap, T., Thye, W., & Aw, G. (2014). A new approach to measuring the liveability of cities: The Global Liveable Cities Index. 11(2), 176-196.

GLA . (2003). *Valuing greenness: Green spaces,*. London: Greater London Authority: house prices and Londoners' priorities.

Harris, W. h., & Dines, N. T. (1988). *Time Saver Standards for Landscape Architecture.* USA: Mcgrow-Hill.

Hassanein, H. (2017). *Smart Technical Street Furniture Design: Case study of "New Cairo Administrative Capital".* Eygpt: International Journal on: The Academic Research Community Publication.

Jensen , m. b., Guldager, s., person, b., Reeh, H., & Nilsson, k. (2000). *Green structure and sustainability: developing a tool for local planning.Landscape and Urban Planning.*

Jim , c. y., & Chen , w. y. (2010). External effects of neighbourhood parks and landscape elements on high-rise residential value. *Land Use Policy*, 27: .

kansoy, i. (1988). *A Study on Exterior Design in Housing Settlements.* istanbul: Istanbul Technical University Institute of Science and Technology ,Unpublished Master Thesis.

Kashef, M. (2016). Urban livability across disciplinary and professional boundaries. *Frontiers of Architectural Research*, 5, 239–253.

Kellett, J., & Matthew , R. w. (2009). . Creating Active Communities: How Can Open and Public Spaces in Urban and Suburban Environments Support Active Living. *Adelaide: Active Living Coalition.*

Kurtulu, m. (1997). *Evaluation of Open Areas in Ata ehir Mass Housing Areas.* istanbul: Istanbul Technical University Institute of Science and Technology Unpublished Master Thesis.

Landcom. (2008). open space design guidelines. LANDCOM project.

Lynch, k. (1960). *Image of the City.* (. Ba aran, Çev.) Istanbul: Turkey Isbank Cultural Publications. 2011 tarihinde alındı

Moughtin, c. (1992). *Urban Design: Street and Square.* Oxford.: Department of Architecture andPlanning, University of Nottingham, Butterworth-Heinemann Ltd.

Neufert, e. (1998). *Building Design.* Cologne.

(2015). *Open Space Provision within New Residential Developments.* OPEN SPACE CONTRIBUTIONS FROM RESIDENTIAL DEVELOPMENT.

Ozkan, B. (2001). *Urban Recreation Area Planning.* zmir.

Özkan, b., & Küçükerba, e. v. (1995). Architectural Knowledge. *Ege University Faculty of Agriculture Publication*, No: 513.

PAMAY, B. (1971). *Park-Garden and Landscape Architecture.* Istanbul: Istanbul University Faculty of Forestry Publications.

Saitluanga, B. (2014). Spatial Pattern of Urban Livability in Himalayan Region: A Case of Aizawl City. 117(2), 541–559.

Sayan, m. c. (2002). *Investigation of Applications in New Settlements in Ankara in Terms of Landscape Design Principles.* ankara: Ankara University Institute of Science and Technology Unpublished Master Thesis.

Seyhan, G. (1991). *A Research on the Investigation of Open and Green Areas in Ankara Eryaman Mass Housing Settlement.* ankara: Ankara University Institute of Science and Technology Unpublished Master Thesis.

South Norfolk Concil Planing Department. (1994). Recreational Open Space Requirements for Residential Areas.

Stoneham, J., & Thoday, p. (1996). *Landscape Design For Elderly And Disabled People.* United Kıngdom: Garden Art Press.

Suba, b. (2000). *Examination of Mass Housing Open Areas in the Applications of Gaziemir District of zmir Province in the Framework of Landscape Architecture Principles.* Izmir: E.U. Unpublished Master's Thesis of the Department of Landscape Architecture, Institute of Science.

T.S.E. (1997). *Rules for the Design of Structural Measures and Markings on Streets, Avenues, Squares and Roads for the Disabled and Elderly on Urban Roads.* Ankara: TS - (TASLAK).

Verhe, I. (1995). *The Adaptation Of Outdoor Activity Areas For The Use Of The Disabled.* Finland: The Finnish Association Of Sports For The Disabled.

Ciaramella, A., Bellintani, S., Savio, L., Carbonaro, C., Pagani, R., Pennacchio, R., . . . Thiebat, F. (2018). *Smart furniture and smart city.* Italy: IOP Publishing.

Jienan, y. (2009). *RESEARCH OF LANDSCAPE DESIGN IN RESIDENTIAL AREA Vanke Fifth Garden & Crystal City in China Bo01 of Western Harbor in Sweden.* The European Spatial Planning Programme. Karlskrona , Sweden: Blekinge Institute of Technology.

Jim, c. y., & Chen, w. y. (2008). *Cost-benefit analysis of the leisure value of urban greening in the new Chinese city of Zhuhai. Cities.*

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Rudlin, D., & Falk, N. (1999). *Building the 21st Century Home, The sustainable urban neighborhood, Architectural Press.* England.

Salih , s. a., & Ismai, s. (2017). Criteria for Public Open Space Enhancement to Achieve Social Interaction: a Review Paper. IOP Conference Series: Materials Science and Engineering.

Sarkissian, W., Bateman , R., Hurley, B., & Young , A. (2013). *OPEN SPACE IN MEDIUM-DENSITY HOUSING GUIDELINES FOR PLANNING AND DESIGN.* Australia: Sarkissian.

Thanoon, M. G., & Haykal , H. T. (2021). Influences of Environmental Quality and safety & security on the Liveability of Residential Complexes in Erbil City. *ZANCO Journal of Pure and Applied Sciences*.

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ASI. (2001). *With SN 521 Norms Accessibility Guide – Structure for Persons with Disabilities.* ASSOC AT ON SU SSE DES NVAL DES, istanbul.

Bigio, A., & Dahiya, B. (2004). *Urban Environment and Infrastructure Toward Livable Cities.* Washington,DC 20433 USA: the International Bank for Reconstruction and Development/THE WORLD BANK.

Bolund, p., & Hunhammar, s. (1999). *Ecosystem services in urban areas.*

Bonenberg, W. (2015). Public space in the residential areas: the method of social-spatial. *Poznan University of Technology, pl. M. Sklodowskiej-Curie 5* (s. 1720 – 1727). Poznan: Procedia Manufacturing.

Booth, n. k. (1989). *Basic Elements of Landscape Architectural Design.* Long Grove, Illinois.: Waveland Press Inc.

Çalı, A. .. (2001). *Creating a Mass Housing Model with Physical, Visual and Social Interaction Features.* Ankara: Ankara University, Faculty of Science, Department of Landscape Architecture, Master's Thesis.

CCPT. (1990). *CENTRAL CO-ORDINATING COMMITTEE FOR THE PROM.*

Cooper Marcus, C. (2003). Shared outdoor space and community life. *Places: A Quarterly Journal of Environmental Design*, 15 (2): 32-41.

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Egeyapı. (2021). *Batisehir*. https://www.egeyapi.com/batisehir adresinden alındı

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Ferguson, p. (2007). The streets of innovation. In: Proceedings of 6th International Space Syntax Symposium., (s. 16). istanbul.

Giap, T., Thye, W., & Aw, G. (2014). A new approach to measuring the liveability of cities: The Global Liveable Cities Index. 11(2), 176-196.

GLA . (2003). *Valuing greenness: Green spaces,*. London: Greater London Authority: house prices and Londoners' priorities.

Harris, W. h., & Dines, N. T. (1988). *Time Saver Standards for Landscape Architecture*. USA: Mcgrow-Hill.

Hassanein, H. (2017). *Smart Technical Street Furniture Design: Case study of "New Cairo Administrative Capital"*. Eygpt: International Journal on: The Academic Research Community Publication.

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Jim , c. y., & Chen , w. y. (2010). External effects of neighbourhood parks and landscape elements on high-rise residential value. *Land Use Policy*, 27: .

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Kashef, M. (2016). Urban livability across disciplinary and professional boundaries. *Frontiers of Architectural Research*, 5, 239–253.

Kellett, J., & Matthew , R. w. (2009). . Creating Active Communities: How Can Open and Public Spaces in Urban and Suburban Environments Support Active Living. *Adelaide: Active Living Coalition*.

Kurtulu□, m. (1997). *Evaluation of Open Areas in Ata□ehir Mass Housing Areas*. istanbul: Istanbul Technical University Institute of Science and Technology Unpublished Master Thesis.

Landcom. (2008). open space design guidelines. LANDCOM project.

Lynch, k. (1960). *Image of the City*. (□. Ba□aran, Çev.) Istanbul: Turkey Isbank Cultural Publications. 2011 tarihinde alındı

Moughtin, c. (1992). *Urban Design: Street and Square*. Oxford.: Department of Architecture andPlanning, University of Nottingham, Butterworth-Heinemann Ltd.

Neufert, e. (1998). *Building Design*. Cologne.

(2015). *Open Space Provision within New Residential Developments*. OPEN SPACE CONTRIBUTIONS FROM RESIDENTIAL DEVELOPMENT.

Ozkan, B. (2001). *Urban Recreation Area Planning*. □zmir.

Özkan, b., & Küçükerba□, e. v. (1995). Architectural Knowledge. *Ege University Faculty of Agriculture Publication*, No: 513.

PAMAY, B. (1971). *Park-Garden and Landscape Architecture*. Istanbul: Istanbul University Faculty of Forestry Publications.

Saitluanga, B. (2014). Spatial Pattern of Urban Livability in Himalayan Region: A Case of Aizawl City. 117(2), 541–559.

Sayan, m. c. (2002). *Investigation of Applications in New Settlements in Ankara in Terms of Landscape Design Principles*. ankara: Ankara University Institute of Science and Technology Unpublished Master Thesis.

Seyhan, G. (1991). *A Research on the Investigation of Open and Green Areas in Ankara Eryaman Mass Housing Settlement*. ankara: Ankara University Institute of Science and Technology Unpublished Master Thesis.

South Norfolk Concil Planing Department. (1994). Recreational Open Space Requirements for Residential Areas.

Stoneham, J., & Thoday, p. (1996). *Landscape Design For Elderly And Disabled People*. United Kıngdom: Garden Art Press.

Suba□ı, b. (2000). *Examination of Mass Housing Open Areas in the Applications of Gaziemir District of □zmir Province in the Framework of Landscape Architecture Principles*. Izmir: E.U. Unpublished Master's Thesis of the Department of Landscape Architecture, Institute of Science.

T.S.E. (1997). *Rules for the Design of Structural Measures and Markings on Streets, Avenues, Squares and Roads for the Disabled and Elderly on Urban Roads*. Ankara: TS - (TASLAK).

Verhe, I. (1995). *The Adaptation Of Outdoor Activity Areas For The Use Of The Disabled*. Finland: The Finnish Association Of Sports For The Disabled.

Murals as Memorials: The Artist's Responsibility

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Abstract
This paper, short though it is, represents my first thoughts on the overlap between street art as memoria and the concept of the artist as implicated subject. That is should we consider the artist who create memorial graffiti as documenters of societies memories or creators of them. In examining the extent to which the making of such art can be considered as an act of shaping rather than reflecting cultural memory I will seek to establish that the artist promotes interaction with both their art and the subject of that art.

Keywords
Graffiti; Memoria; Cultural Memory; Implicated Subject; Murals.

1. Introduction

The concept of the implicated subject was first developed by Rothberg, when discussing the interlocking levels of culpability associated with the artistic representation of trauma. (Rothberg, 2000) His distinction between the impartial observer, who could perhaps be seen as a mere spectator of events, and the witness, who seeks to interpret or redefine the events for others is key if we are to use this term in our analysis of street art as memoria. It seems appropriate to ask if it is the image, or the accompanying text that reflects the message and does either, or both, represent the intention of the artist or have the meanings changed when interpreted by the local community. By addressing this question I will endeavor to provide a platform from which to start a discussion about the relationship between the artist and the community in memorial murals.

2. Start with the Political

George Orwell is frequently misquoted as saying that 'all art is political'(Orwell, 2018) – he was, in truth, discussing the impact of politics on writing rather than art – but, if we are to misquote Orwell once we may as well do so again and say that, if 'All art works are political, … [but] some are more political than others.'(Orwell, 2003). There are murals painted to commemorate the heroes of war, the heroes of civil unrest and heroes of revolution. These paintings, such as that of Bobby Sands in Belfast, (D, 1998) or the 2020 *Heroes of the Great Patriotic War* depicted in Moscow, (Various, 2020) are usually state, or quasi-state sanctioned, and, although clearly political in nature, are outside the scope of this essay. This is because the sponsorship of this art means that the risks of engaging with these artworks means that there is very little public interaction with them. This can be contrasted with community artworks such as the *Say Their Names* mural in Springfield, USA (Wane One et al., 2020), *Through Art We Rise* in Hampstead, UK (Xhafa-Mripa et al., 2020), Akse P19's mural of George Floyd in Manchester, UK. (Akse P19, 2020), or even the Safer Streets murals which filled the Leake Street Tunnel in Waterloo, UK.(WOM Collective, 2021) These artworks, and others like them, are produced in response to live issues. They represent a local interpretation of larger political issues such as police violence, homelessness and violence against women. This being the case it is appropriate to ask why these artworks are so often defaced or destroyed.

3. Claiming the Issue; Claiming the Space

It may be that the problem with political murals in community spaces is the fact that the spaces are communal; any public space is likely to be contested. Take, for example *Through Art we Rise*, an artwork commissioned by Justice Through Arts which was founded by the conceptual artist Alketa Xhafa-Mripa. This consisted of two murals painted on each side of the ThamesLink Bridge in West Hampstead. One side of the bridge, painted by the artist Zabou, was painted with portraits of three people who he described as 'The Forgotten Ones'. The intention of this mural was to humanize the homeless by making passes by look at them. The inspiration for the mural was he death of a local man, who sat by the bridge every day. However, complaints were made that the mural was inaccurate as the man who inspired the work, John Henderson, was not homeless. In addition the artist who painted the mural on the opposite side of the bridge, Ben Eine, was a controversial figure. The mural was defaced, said to be in breach of planning regulations and finally partially removed by the artists. The question then is, did the artists have the moral right to place the artwork on this site? Legally they had the right, the owners of the bridge had agreed and planning permission had be sought, but they clearly did not had the unanimous support of the community. But is unanimous support a realistic goal, or even one to which we should aspire? Take, for example, the cases of the memorials to George Floyd, several of these have been vandalized by overpainting, whiting-out or by the addition of racist messages. Clearly some members of the community did not support the painting of these murals, but there appears to be little indication that the majority of the communities in which they are situated feel the same way. Would we want the artist to alter their work to represent the messages sent by the vandals anyway, surely not? Therefore, we must return to my original question, do the artists expect to shape the opinions of the community or to reflect them, and how does that alter the art itself.

4. My Views or Yours

If we assume that the painters of memorial art think that their views align with those of the community that host their art perhaps we should ask why they have chosen to paint the work, particularly if, like Alketa Xhafa-Mripa, they describe themselves as Activist Artists. However, as the definition of community is so nebulous at what point to we say that the art is supported by the community? Is it community art if some members of the local community take part in the production, or is it sufficient if they help to fund it, or perhaps support can be assumed if there are less than ten, twenty or a hundred complaints? Moreover, is there a risk that such public murals may memorialize the subjects in ways that their families do not support? Such depictions, even if well meaning, may cause more distress to the families than would have been the case if the artwork had not been painted. Take for example the George Floyd memorial artworks. The artists are undoubtedly showing their support by reproducing George's image as a larger than life mural. Something that his family have said that they support. However, is it not possible that when the murals are defaced by racist slogans this could cause the family additional hurt; equally the presence of the murals on the streets may also function as a magnet, providing a focus for racist groups or individuals. The artwork becomes more political by being defaced, and more political again when it is repainted to cover the original destruction. In essence the painting and repainting of these memorial artworks becomes a public debate about the subject being memorialized. The act of producing a disputed memorial is sufficient for the artist to become an implicated subject, as they are not merely recording facts, but are initiating a discussion, however distasteful, about the merits of the memorial.

5. Conclusion

The production of public memorial murals is not a neutral activity. It is a political act, even if the subject is not innately political. In addition I believe that the painting of such murals, and their disfigurement represents a political discussion between different sections of the community and because the artist has initiated this discussion they cannot be considered to be an impartial observer, but rather an implicated subject in that they are driving the direction of this discussion.

Conflict of Interests

The author declare no conflict of interests.

References

Akse P19. (2020). *George Floyd Mural* [Acrylic paint on concrete]. https://www.greatermancunians.blog/akse-p19-street-artist-manchester

Allmer, P. (2009). *On Being Touched: Essay to Accompany Carson & Miller's artists' book Scrapbook (the story of things) and the exhibition The Story of Things*. Manchester Metropolitan University. https://www.pure.ed.ac.uk/ws/portalfiles/portal/53840238/Allmer_On_Being_Touched.pdf

D, D. (1998). *Bobby Sands Mural*. https://theculturetrip.com/europe/ireland/articles/irelands-most-powerful-murals/

Orwell, G. (2003). *(Misquote from) Animal Farm*. Penguin.

Orwell, G. (2018). (Misquote from) Politics and the English Language. In *Politics and the English Language and Other Essays* (ebook, pp. 5–24). Howard Ross. file:///C:/Users/bab1n15/AppData/Local/Temp/20180223-a5.pdf

Rothberg, M. (2000). *Traumatic Realism: The Demands of Holocaust Representation*. Univerity of Minnesota Press,.

Rothberg, M. (2020, December 11). *Multidirectional Memories and the Possibilities of Art*. Multidirectional Memories, Kemper Art Museum St. Louis.

Various. (2020). *Heroes of the Great Patriotic War*. https://sputniknews.com/photo/202004291079131821-murals-painted-in-russia-in-celebration-of-wwii-victory/

Wane One, Nero, & Souls NYC. (2020). *Say Their Names Mural* [Acrylic Paint on brick]. https://www.commonwealthmurals.org/say-their-names

Whitlock, G. (2020). Implicated Subjects. *Autobiography Studies*, *35*(2), 495–501.

WOM Collective. (2021). *Claim Back the Streets* [Acrylic paint on concrete]. https://inspiringcity.com/2021/03/14/street-artists-paint-in-support-of-safer-streets-for-women

Xhafa-Mripa, A., Zabu, & Eine, B. (2020). *Through Art We Rise* [Acrylic Paint on brick].